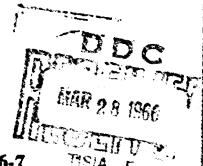
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OXIDATION-CORROSION CHARACTERISTICS OF AIRCRAFT TURBINE ENGINE LUBRICANTS

J. P. Cuellar B. B. Baber P. M. Ku

Southwest Research institute



TECHNICAL REPORT NO. AFAPL-TR-66-7
February 1966

Air Force Aero Propulsion Laboratory

Research and Technology Division

Air Force Systems Command

Wright-Patterson Air Force Base, Ohio

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ERRATA - March 1966

The following corrections are applicable to AFAPL-TR-66-7, Oxidation-Corrosion Characteristics of Aircraft Turbine Engine Lubricants, February 1966:

Page 7

Substitute the entire Table 1 given below for the Table 1 now printed on this page:

TABLE 1. DESCRIPTION OF TEST LUBRICANTS

Oil Code	Viscosi 100°F		NN, mg KOH/g	Description
0-60-8	16,1	4, 2	0,18	*MIL-L-7808 E type
0-60-18	12, 1	3. 2	0,19	MIL-L-7808 E
0-61-11	15.7	4, 1	0,39	MIL-L-7808 E
0-62-3	15,3	3. 6	0,02	MIL-L-7808 E
0-62-4	15.0	3.9	0.11	*MIL-L-7808 E type
0-62-6	17,8	4.7	0,24	MIL-L-7808 E
0-62-7	17,4	4,2	0.01	*MIL-L-7806 type
0-62-13	16.0	4. 2	0.25	MIL-L-7808 E
0-62-16	16.8	4.4	0,22	MIL-L-7808 E
0-63-1	17.5	4,6	0.23	*MIL-L-7603 type
0-63-2	16, 3	4, 3	0, 22	*MIL-L-7806 type
0-63-3	15, 2	4, 1	0, Z4	*MIL-L-7808 type
0-63-7	12.8	3, 4	0.10	MIL-L-7808 type
0-63-8	13.6	3.5	0.15	*MIL-L-7808 E type
0-63-12	15.5	3.9	0,23	MIL-L-7808 type
0-63-13	16.9	4,4	0.05	MIL-L-7808 type
0-63-16	16,5	4,3	0,29	MIL-L-7308 E
0-64-2	27.5	5, 1	0,07	MIL-L-23699
0-64-12	13.8	3,5	0,25	*MIL-L-7808 D
0-64-13	28.4	5, 5	0.25	MIL-L-23699 type
0-64-16	13, 1	3,3	0,17	MIL-1-7808 D
0-64-18	16.8	4,3	0,11	*MIL-L-7808 E
0-64-21	15,6	3,6	0.07	MIL-L-7808 type
0-64-22	18,3	4,1	0,17	MIL-L-7808 type
0-64-25	28,8	5,4	0,0	*MIL-L-23699
0-64-26	12,8	3,1	0, 33	MIL-L-7808 type
0-65-1	14.9	3,8	0.07	MIL-L-7808 type
0-65-2	13.3	3,1	0,64	MIL-L-7808 type
0-65-3	17.0	4,5	0,24	MIL-L-7808 type
0-65-4	27.9	5, 3	0,15	MIL-L-23699 type
0-65-5	19,4	4,0	0.15	MIL-L-7808 type
0-65-8	19,1	4,1	0,01	MIL-I-7808 type
0-65-14	17.7	4,7	0,24	MIL-L-7806 type
0-65-15	27.2	5.0	0. OZ	*MIL-23699
0-65-16	26.7	5, 1	0,20	*MIL-1-23699
0-65-18	17.6	4,6	0,21	MIL-L-7808 type
0-65-19	17.7	4,7	0.25	MIL-L-7806 type
0-65-21	15.1	3,8	0.07	MIL-L-7808 type
0-65-23	12.6	3,2	0, 20	MIL-L-7808 type
0-65-24	15,2	3,7	0,13	Mil-L-7805 type
0-65-27	15,2	4,0	0,26	M -L-7806 type
0-65-28	12.9	3, 3	0, 30	MIL-L-7808 type
0-65-31	13.4	3,2	0,06	MIL-1-7808 1790
65-L-114	13,5	3,5	0,10	MIL-L-7800 E
(5-L-113	14.3	1,6	0,09	MIL-1-7806 Z
65-L-116	16, 8	4.3	0,11	MIL-1-7806 E
J-1003(=)	14,8	3,8	9,10	Bland of 45-1,-114, -115, and -116
J-1307(a)	16.5	4,2	0,15	Blend of 0-62-3 and 0-62-6
J-1011(4)	28, 4	5.4	0,14	Bland of 0-64-13 and 0-64-25
1-1020(4)	27.9	5.2	0,17	Blend of 0-64-2 and 0-64-13
J-1021(2)	28,1	5.2	0,04	Blend of 17-64-2 and 0-64-25
1-1029(4)	28,2	5,2	0, 12	Bland of 0-64-2, 0-64-13, and 0-64-25

⁽a) Blands consist of equal parts by volume of the indicated constituents,

Description changed from that shown in original report.

OXIDATION-CORROSION CHARACTERISTICS OF AIRCRAFT TURBINE ENGINE LUBRICANTS

J. P. Cuellar B. B. Baber P. M. Ku

Southwest Research Institute

FOREWORD

This report was prepared at Southwest Research Institute under Contract AF 33(615) 2384. The contract was initiated under Project No. 3044, Task No. 304401. The work was administered by the Fuels, Lubrication, and Hazards Branch, Air Force Aero Propulsion Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. The project engineers were Messrs. G. A. Beane and L. J. DeBrohun and Lt. J. C. Ghiglieri.

This report covers one phase of work performed under the subject contract in the period of February 1, 1965 through September 1, 1965. The manuscript of this report was released by "e authors October 1965 for publication as an AFAPL Technical Report.

This technical report has been reviewed and is approved.

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ABSTRACT

Oxidation-corrosion test data are presented for 46 lubricants, 40 MIL-L-7808 type lubricants and six MIL-L-23699 type lubricants, evaluated at one or more temperatures within the range of 350 to 400°F. In addition, the compatibility of selected lubricants when blended with lubricants of the same general class was evaluated. The test conditions which were varied were temperature and the use of reflux and nonreflux glassware configurations. Relatively mild oxidative degradation occurred at 350 and 375°F test conditions. Using an arbitrary rating point of 100 percent viscosity increase (100°F) as the maximum viscosity increase allowable for satisfactory performance, 23 of the 37 lubricants evaluated at 385°F were satisfactory using the nonreflux test procedure. Sixteen of the 29 lubricants evaluated at 390°F were satisfactory and only four of the 16 evaluated at 400°F provided satisfactory performance. The effect of condensate return at 385°F revealed that the majority of lubricants evaluated were unaffected.

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SECTION I

INTRODUCTION

This report summarizes a selected portion of the work performed at Southwest Research Institute in the period of February 1, 1965, through September 1, 1965, under Contract AF 33(615)-2384, entitled "Lubrication Research for Aero Propulsion Systems." The objectives of this broad program are the development or refinement of lubricant evaluation techniques for aero propulsion systems, and the evaluation of candidate lubricants and lubrication techniques. This report is concerned with only one phase of the overall effort: the oxidation-corrosion characteristics of selected lubricants and lubricant blends in the temperature regime of 350 to 400°F. Work performed under other phases has been dealt with in one previous report* and will be presented in other future reports.

The oxidation-corrosion characteristics of 46 lubricants and six lubricant blends were determined by means of a 48-hour glassware-type test, using a thermostated oil bath. These lubricants, all of MIL-L-7808 and MIL-L-23699 types, were selected and provided by the Air Force Aero Propulsion Laboratory.

^{*}Lubrication Research for Aero Propulsion Systems, Phase Report No. 1, Bearing Support Deposits Program, AFAPL Technical Report 65-118, October 1965.

SECTION II

TEST APPARATUS AND PROCEDURES

A. Test Glassware

The test sample tubes are constructed of standard wall 51-mm Pyrex tubing with a round bottom. A standard taper 71/60 outer joint is provided at the tube top. Overall tube length is 450 ± 10 mm, and the tube immersion depth within the oil-bath is 225 ± 10 mm.

The test tube head is constructed with a standard taper 71/60 ground-glass joint on the lower end which mates with the test cell joint. The upper surface of the head is formed in a dome-shaped contour. Attached to this surface are three female, ground-glass joints. A 10/30 joint is centrally located to accommodate the air tube. A second 10/30 joint, slightly offset from center, provides for temperature measurements and intermediate sampling. Offset and at a 90° position from the sampling port, a 24/40 joint is attached to relieve effluent vapors. Using the condensate return procedure, a 300-mm water-cooled Allihn condenser is directly attached to the latter joint. The nonreflux test procedure employs a connecting arm, with a 15° downward slant, between the 24/40 joint and an overboard condenser. For this work, a 200-mm water-cooled Graham condenser was used.

An air delivery tube of standard 6-mm Pyrex tubing, approximately 600 mm in length, is fixed in the upper end of the head by means of a one-hole cork. The tip of the air tube is cut at a 45° angle and rests directly on the bottom of the sample tube. A small glass collar of sufficient size to hold the metal specimens is located 15 mm from the tip of the air tube. The bottom metal specimen rests directly on this collar, and succeeding specimens are separated by glass spacers 6-mm wide, cut from standard 9-mm Pyrex tubing.

B. Heating Bath

A stirred, thermostated oil bath was employed as the test glassware heat medium. The unit is operated within a fume hood to avoid toxic vapors. As illustrated in Figure 1, the enclosed bath is raised above bench level to allow for operation using overboard condensers for the collection of condensable vapors. The bath will accommodate a maximum of six sample tubes using either a nonreflux glassware configuration (Fig. 1) or a reflux configuration in which the vapor condensers are attached directly above the sample tubes. Tube immersion depth is such that the sample level is approximately 125 mm below the bath level at test temperature.

Temperature control of the oil bath is provided by four 600-watt immersion heaters, one of which is controlled by an adjustable thermoswitch.

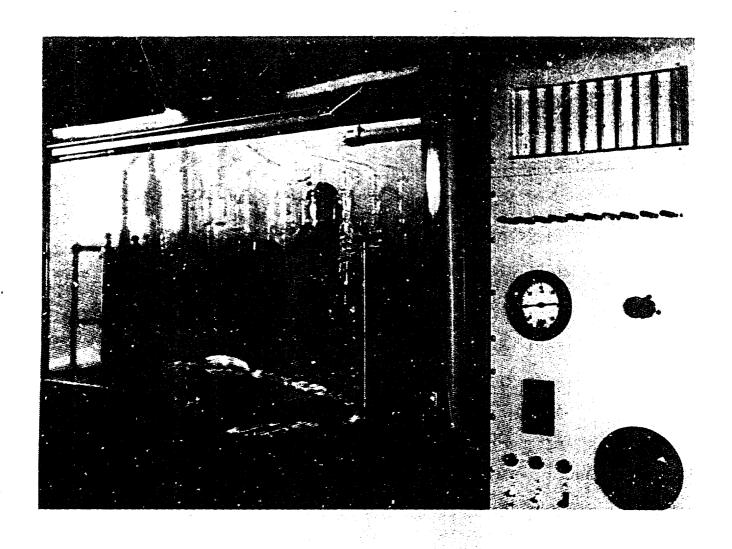


FIGURE 1. OXIDATION-CORROSION TEST APPARATUS

In operation, the continuously-on heater elements are adjusted for optimum control by means of a variable transformer.

C. Air Supply System

A precision air regulator is used to provide a constant air pressure to individual fine-thread needle valves from the laboratory air line. The air is passed through a 4-in. glass-pipe drying column, containing a calcium sulfate drier, thence to a manifold before reaching the individual test tube control valves and flowmeters. Each of the six air flowmeters was calibrated by means of a wet test meter in order to provide accurate measurement of the air flow rate.

D. Metal Test Specimens

The metal corrosion specimens are of the round washer type with dimensions 3/4-in. OD and 1/4-in. ID by 0.032-in. thickness. The following material designations apply to the metals which were used:

Aluminum QQ-A-250/4b, temper T-3 or T-4

Silver Electrolytic grade, 99.9%

Copper QQ-C-576b

Mild steel QQ-S-698, grade 1009, cold rolled,

temper No. 4 or 5

Magnesium QQ-M-44a (AZ31B)

Titanium MIL-T-009046 B (ASG), Class 1

As previously noted, the specimens are stacked directly on the air tube, separated by 1/4-in. glass spacers. The metals are arranged in the order given above with aluminum in the lowest position.

E. Test Procedures

In evaluating the oxidation-corrosion properties of the submitted lubricants, only two test conditions were varied: sample temperature and the use of condensate return. In the initial stages of work, lubricant performance was determined at several temperatures (350, 375, 385, 390, and 400°F) in order to select that temperature which would result in a reasonable degradation level. Subsequent tests were generally limited to evaluation at 385 and/or 390°F. All temperatures cited herein refer to sample operating temperature, not bath temperature which is normally 2 to 3°F higher than the sample temperature.

The normal test duration was 48 hours with intermediate sampling (20 ml) at 16, 24, and 40 hours. In some instances, due to severe oil loss or deterioration, the run was terminated at an intermediate sample time. No makeup oil was added for the samples drawn or the oil losses.

The initial sample charge was 200 ml. Test air flow rate was 130 liters/hour dry air. A six-metal corrosion specimen group was used consisting of aluminum, silver, copper. mild steel, magnesium, and titanium.

All lubricant samples were analyzed to determine kinematic viscosity at 100 and 210°F, and neutralization number. In evaluations using the non-reflux apparatus, the overhead fluid was analyzed for 100°F viscosity and neutralization number. Metal specimen attack was determined by weight diference. In addition, the coupons were examined at a 20X microscope magnification to observe the type of metal corrosion, e.g., pitting or etching. Postest preparation of the metal specimens included a successive rinse in benzene and acetone to remove oil. The individual specimens were benzene swabbed using a series of cotton swabs until clean swabs were noted. The coupons were finally rinsed in benzene and acetone, air dried, and weighed.

For one test series, an electrocleaning procedure was employed following the normal specimen cleanup. The individual metals, except aluminum, were cathodically cleaned in a hot (170 to 190°F) caustic bath. The bath contained an aqueous solution of 15 g/liter sodium hydroxide and 15 g/liter trisodium phosphate. The coupons were cleaned as the cathode for a period of 15 to 30 seconds using a current density of 0.5 amp/inch². After removal from the bath, the specimens were rinsed in cold water and cotton swabbed to remove loose deposits. The metals were weighed after a final rinse in acetone. The aluminum specimens were soaked in concentrated nitric acid for a period of 15 minutes, then rinsed and processed as described above.

Test glassware deposits and sludge were likewise recorded. After test, the entire sample was filtered through a 200-mesh screen to observe bulk sludge deposits. A 25-ml portion of the lubricant sample was then subjected to a 1-hour centrifuging at a relative force of 840 g's in order to measure suspended sludge.

In general, all candidate lubricants were initially evaluated using non-reflux of effluent vapors. Many of the oils were then run to determine the effect of refluxing. All other test conditions, including air flow rate, were the same for both cases. All determinations using condensate return were conducted at 385°F.

SECTION III

TEST LUBRICANTS

A total of 46 lubricants and six lubricant mixtures were evaluated at one or more of five sample temperatures used in the test series. Table I presents a listing of the lubricants employed in this program, along with initial viscosity and neutralization number data and available information on lubricant type. Six of the test fluids are typical of the class defined by specification MIL-L-23699. The remaining oils are related to the lubricant type described by MIL-L-7808.

TABLE 1. DESCRIPTION OF TEST LUBRICANTS

Oil Code	V18CC2		NN, mg KOH/g	Description
Oil Code	7.00 F	210 1	mg ACAH B	Description
0-60-8	16.1	4.2	0.18	MIL-L-7808 E
0-60-18	12.1	3,2	0.19	MIL-L-7808 E
0-61-11	15.7	4.1	0.39	MIL-I7808 E
0-62-3	15.5	3.8	0.02	MILL-7808 E
0-62-4	15.0	3.9	0.11	MIL-L-7808 E
O-62-6	17.8	4.7	0.24	MIL-L-7808 E
0-62-7	17.4	4.2	0,01	MIL-L-7808 D
0-62-13	16.0	4,2	0.25	MIL-L-7808 E
0-62-16	16.8	4,4	0.22	MIL-L-7808 E
O-63-1	17.5	4.6	0,23	MIL-L-7808 D
0-63-2	16.3	4.3	0.22	MIL-L-7808 D
O-63 - 3	15.2	4, l	0.24	MIL-L-7808 D
O-63-7	12.8	3.4	0.10	MIL-L-7808 type
O-63-3	13.8	3.5	0.15	MIL-L-7808 E
0-63-12	15.5	3.9	0,23	MIL-L-7808 type
O-63-13	16.9	4.4	0.05	MIL-L-7808 type
0-63-16	16.5	4.3	0.29	MIL-L-7808 E
0-64-2	27.5	5.1	0.07	MIL-L-23699
0-64-12	13.8	3.5	0.25	MIL-L-7808 E
0-64-13	28.4	5.3	0.28	MIL-L-23699 type
0-64-16	13,1	3,3	0.17	M1L-L-7808 D
0-64-18	16.8	4.3	0.11	MIL-L-7808 type
0-64-21	15,6	3.6	0.07	MIL-L-7808 type
0-64-22	18.3	4, 1	0.17	MIL-L-7808 type
0-64-25	28.8	5.4	0.0	MIL-L-23699 type
0-64-26	12.8	3.1	0,33	MIL-L-7808 type
0-65-1	14.9	3.8	0.07	MIL-L-7808 type
0-65-2	13,3	3.1	0.64	MIL-L-7808 type
0-65-3	17.0	4,5	0.24	MIL-L-7898 type
0-65-4	27.9	5.3	0.15	MIL-L-23699 type
0-65-5	19.4	4.0	0.15	MIL-L-7808 type
0-65-8	19.1	4.1	0.01	MIL-L-7808 type
0-65-14	17.7	4.7	0,24	MIL-L-7808 type
O-65-15	27, 2	5.0	0.02	MIL-L-23699 type
0-65-16	26.7	5.1	0.20	MIL-L-23699 type
O-65-18	17.6	4, 6	0.21	MIL-L-7808 type
0-65-19	17.7	4,7	0.25	MIL-L-7808 type
0-65-21	15.1	3.8	0.07	MIL-L-7808 type
O-65-23	12.6	3.2	0.20	MIL-L-7808 type
0-65-24	15.2	3.7	0.13	MIL-L-7808 type
O-65-27 O-65-28	15.2	4.0	0.26	MIL-L-7808 type
0-65-31	12.9 13.4	3,3 3,2	0.30	MIL-L-7808 type
65-L-114	13.5	3,5	0.08 0.10	MIL-L-7808 type MIL-L-7808 E
65-L-115	14.3	3.6	0.09	MIL-L-7808 E
65-L-116	16.8	4.3	0.07	MIL-L-7808 E
j. 1003(a)	14.8	3.8	0.10	Blend of 65-L-114, -115, and -116
J-1007(a)	16.5	4.2	0.15	Blend of C-62-3 and O-62-6
J-1011(a)	28.4	4,2 5,4	0.13	Blend of C-64-13 and O-64-25
J-1020(a)	27.9	5.2	0.17	Blend of 0-64-2 and 0-64-13
J-1021(a)	28.1	5.2	0.04	Blend of O-64-2 and O-64-25
J=1025(a)	28.2	5.2	0,12	Blend of 0-64-2, 0-64-13, and 0-64-25
0 10001	20, 5		~ , * w	Elene of a stray and trady and and the

⁽a) Blends consist of equal parts by volume of the indicated constituents,

SECTION IV

TEST RESULTS AND DISCUSSION

A. Effect of Test Temperature

As a consequence of the large volume of data generated by this work, the following discussions are generally confined to the use of data summaries. Tables 10 to 168 in the Appendix present the detailed results of all determinations. These tables are listed in numerical order by oil code and not necessarily by the testing sequence.

Lubricant viscosity increase was used in this program as the primary criterion in determining lubricant performance. As a general rule, a 100°F viscosity increase in excess of 100 percent was arbitrarily considered the failing point. This rule was not strictly applied, however, and was not intended by any means to indicate official Air Force approval or disapproval. One hundred percent lubricant viscosity increase was used herein chiefly as a dividing line in categorizing fluid capability.

Table 2 summarizes viscosity increase data as affected by increasing test temperature. Lubricant degradation generally followed the normal trend with respect to increasing sample temperature. Viscosity indicated a gradual rise with temperature up to the level of about 100 percent increase. At temperatures beyond that for which a 100 percent viscosity increase was obtained, sample deterioration abruptly accelerated. This observation normally held true with respect to sample neutralization number as shown in Table 3. A typical example of this trend is illustrated for lubricant O-62-3 in Figure 2.

Using 100 percent viscosity increase as the measure of lubricant performance, Table 2 shows that all lubricants evaluated at 350°F underwent relatively mild degradation. Similarly, of the 16 lubricants tested at 375°F, only O-60-8 was unsatifactory. At the maximum temperature investigated, 400°F, severe deterioration, and in most cases gelation, of the lubricant occurred at 48 hours. Sixteen lubricants were run at 400°F and four showed a passing performance. Of these four, O-63-8, O-64-12, and O-64-22 were MIL-L-7808 type and O-64-2 was MIL-L-23699 type. The remaining five MIL-L-23699 lubricants were not examined at 400°F.

In view of the foregoing observations, it is apparent that the test temperature of most interest, i.e., which gives a reasonable separation among the lubricants, lies within a rather narrow range between 375 and 400°F. Thus, as shown by Table 2, the bulk of the program was conducted at 385 and 390°F. On the basis of sample viscosity, the following data classify the lubricant group with regard to temperature capability:

TABLE 2. SUMMARY OF OXIDATION-CORROSION TEST VISCOSITY INCREASE DATA

Oil	100	°F Viscosi	ty Increase, %	% at 48 hr, for	r Test at
Code	350°F	375°F	385°F	390°F	400°F
0040					
0-60-8	40	145	390	482	Gelled(c)
O-60-18	10	15	25	32(a)	38 (a, c)
0-60-18			103(a)	153(a)	8Z (c)
	19	44	72	86(a)	387 (a)
0-62-3	26	48	107(a)	241	128 (c)
0-62-4	17	43	107(5) 122(b)	176(a, c)	Gelled(c)
0-62-6	23	67	122101	144	Cenedia
0-62-7					Gelled(c)
0-62-13		66	144	327 155(a, c)	Gelled(c)
0-62-16		57	70		Cettegray
0-63-1				428	
0-63-2				94 871(c)	
O-63-3					
0-63-7				67(c)	
0-63-8		29	20	24	38
0-63-12				62	
0-63-13				26	4.5
0-63-16			170	320	Gelled(c)
0-64-2		15	19	22	28
0-64-12		13	14	16	23
0-64-13		17	24	26	183
0-64-16			5	28(a)	1365(c)
0-64-18		20	27	31	1140(c)
0-64-21			_,	8	
0-64-22			10	12	16
			11		
0-64-25			109	127	
0-64-26			532	2402	
0-65-1			50	60	
0-65-2				00	
0-65-3			319	10	
0-65-4			16	18	
0-65-5			31 8(a)	38	
0-65-8					
0-65-14			577	.*	
0-65-15			16		
0-65-16			16		
0-65-18			148		
0-65-19			59		
0-65-21			76		
0-65-23			141		
0-65-24			34		
C-65-27			1768		
0-65-28	J.		12,650		
0-65-31			59		
65-L-114		27	52		
65-L-115		16	22		
65-L-116		17			
· · · -			•		

Without condensate return

- (a) Average of duplicate determinations.
- (b) Average of triplicate determinations.
- (c) Values are 40-hr results. In all cases where data are shown for 40 hr, the sample indicated gelation at 48 hr.

TABLE 3. SUMMARY OF OXIDATION-CORROSION TEST NEUTRALIZATION NUMBER DATA

Oil	4	8-hr Neutrali:	ration Number, r	ng KOH/g, for Tea	it at
Code	350°F	375°F	385°F	390°F	400°F

0-60-8	0.49	1.03	1.67	1,68	25.4 (c)
0-60-18	0.42	0.73	1.10	1.64(a)	1.98(a,c)
0-61-11	0.83	9.85	1.28(a)	1.69 ^(a)	1.71(c)
0-62-3	0.52	0,86	1.21	1,41(a)	10.05(a)
		1,23	1.70(2)	2,22	2.49(c)
0-62-4	0.62	0.90	8.75(b)	33.6 (a)	37.9 (c)
0-62-6	0,58	0.70	0,13.	9.01	
0-62-7		1.03	1.54	3,17	25.2 (c)
0-62-13		0.99	13.96	31.3 (a)	40.1 (c)
0-62-16		0, 77	13. 70	18.93	- •
0-63-1				11.58	
0-63-2				23.7	
0-63-3				1.39(c)	
0-63-7			0.50	0.63	0.91(a)
0-63-8		0.55	0.50	0.91	 ,
0-63-12					
0-63-13				1.65	30.3 (c)
0-63-16			1,14	6.73	0.47
0-64-2		0.31	0.38	0.36	2.24
0-64-12		0.96	1,27	1.36	
0-64-13		0.07	0.10	0.09	5,73 49.6
0-64-16			1.57	12.68(a)	34.8 (c)
0-64-18		1.10	1.69	3,19	34.8 (**
0-64-21				0.26	
0-64-22			0.41	0.48	0.54
0-64-25			0.15		
0-64-26			0.41	0.46	
0-65-1			26,2	21.5	
0-65-2			0.09	0.07	
0-65-3			2.01		
0-65-4			0.50	0.48	
0-65-5			0.30	0.31	
0-65-8			0.21(a)	e.	
0-65-14			28.9		
0-65-15			0.45		
0-65-16			0.54		
0-65-18			1.85		
0-65-19			1.29		
0-65-21			1.25		
0-65-23			0.84		
0-65-24			0.64		
0-65-27			3.48		
O-65-28			21.80		
			0.65		
0-65-31		0,83	1.19		
65-L-114 65-L-115		0.43	0.49		
65-L-116		0.98			
07-77-110		/-			

Without condensate return.

⁽a) Average of duplicate determinations.

⁽b) Average of triplicate determinations.

⁽c) Values are 40-hr results.

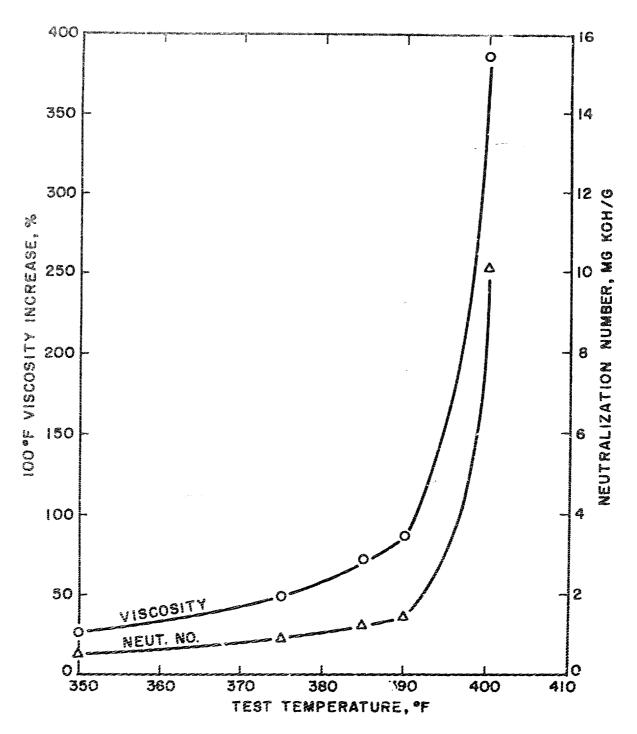


FIGURE 2. EFFECT OF TEMPERATURE ON THE OXIDATIVE DETERIORATION OF O-62-3

	Test Temperature, *F				
	350	375	385	390	400
Number of lubricants tested	6	16	37	29	16
Number of lubricants passed	6	15	23	16	4

Several duplicate determinations were conducted using the nonreflux test configuration in order to verify the repeatability of the procedure. These results showed very good correspondence of all measured daya. The repeatability of viscosity data was the primary concern in this study and, as illustrated by the analysis given in Table 4, the results showed rather good agreement. Only one instance of poor repeatability of duplicate tests was observed. Lubricant O-62-3 when tested at 400°F gave a difference from the mean of 52 percent. This variation, however, is not considered significant in view of the very high level of fluid degradation. The individual determinations in this case were 590 and 184 percent viscosity increase at 100°F.

Metal specimen corrosion for this test series was observed in several cases but was generally confined to the copper and magnesium metals. Significant metal corrosion as described here is defined as a specimen weight loss of 0.20 mg/cm², or more. Some lubricants, which will be identified later, caused significant specimen weight gains, i.e., an increase of 0.20 mg/cm², or more. The latter phenomenon was not restricted to a particular metal type but affected all specimens of the group at random.

Table 5 lists the lubricants and metals for which significant corrosion was obtained in the nonreflux test series. Where no comment is noted for a particular temperature in the table, no test was conducted for that lubricant-temperature combination. As mentioned earlier, corrosion was generally limited to the copper and magnesium metals. The sole exception was a measurable weight loss for silver in the O-61-11 test conducted at 390°F. None of the lubricants evaluated at 350°F showed corrosion of any type. As illustrated in Table 5, metal attack in the 375°F determinations was relatively rare and was confined to copper only. It will be noted that, up to and including the 385°F runs, copper was the only metal indicating attack. At 390 and 400°F, corrosion was more frequently noted for copper, along with two cases of magnesium attack at 390°F and six cases at 400°F.

As discussed herein, metal specimen condition is separated according to those instances of corrosion (weight loss) and those of deposition (weight gain). In the latter case, it should be noted that a combination of corrosion and deposition may prevail, i.e., metal weight loss might be obscured by the presence of significant deposits which cause an overall weight gain.

TABLE 4. REPEATABILITY OF OXIDATION-CORROSION TEST VISCOSITY RESULTS

Oil Code	No. of Detins	Test Temp, °F	Mean 100°F Vis Increase, %	Max Difference from Mean(a), %
0-60-18	2	390	32	1
	2	400	38(b)	3
0-61-11	2	385	103	15
	2	390	153	12
0-62-3	2	390	86	1
	2	400	387	52
0-62-4	2	385	107	6
0-62-6	3	385	122	6
	2	390	176(b)	18
O-62-16	2	390	155(b)	12
0-64-16	2	390	28	11
0-65-8	2	385	8	0

Without condensate return.

⁽a) Max difference from mean X 100/mean

⁽b) Values are 40-hr results.

TABLE 5. SIGNIFICANT METAL SPECIMEN CORROSION

Significant Metal Corrosion for Test at 350°F 390°F 400°F Oil Code 385°F 375° F CuCu, Mg None None 0-60-8 None Ag None None None 2-61-11 None Cu, Mg Cu None 0-62-3None None Cu Cu Cu, Mg None 0-62-6None Cu 0-62-7 CuNone None None 0-62-13Cu, Mg Cu None None 0-62-16 Cu, Mg 0-63-7Cu, Mg Cu Cu Cu 0-63-8Cu 0-63-12 None Mg None 0-63-16None CuNone None 0-64-2 Cu Cu Cu 0-64-13Cu None None Cu 0-64-18Cu 0-64-21Mg 🚬 None None 0-64-22 Cu Cu 0-64-26CuCu0-65-1Cu Cu 0-65-2 Cu Cu 0-65-4Cu Cu0-65-5None Cu65-L-115

Significant metal corrosion, as used here, is defined as a specimen weight loss of 0.20 mg/cm^2 or more.

The occurrence of significant metal specimen weight gain is described in Table 6. Again, the phenomenon is seen to occur more frequently at the higher test temperatures. In addition, it is apparent that no one metal type was predominantly affected. All metals were susceptible to the deposition effect. Those instances in which all specimens except copper showed significant weight gains are probable illustrations of the effect mentioned previously whereby metal corrosion (weight loss) was offset by the added deposit weight.

The use of an electrocleaning procedure was briefly investigated in the assessment of metal specimen corrosion. The technique was employed on one set of six lubricants evaluated at 385°F using nonreflux. After the normal post-test cleanup, all specimens were processed with the electrocleaning method. The results indicated that specimen weight change was essentially unaffected except for one instance using lubricant O-64-26. These data are listed here:

	Weight Change, mg/cm ²				
	Normal	Electrocleaned			
Al	0. 0	-0.06			
Ti	0.0	-0. 02			
Ag	-0.06	-0.06			
Steel	0.0	-0.02			
Cu	-0.28	-0.36			
Mg	+0.20	+0.06			

Although electrocleaning resulted in a slight weight loss for most metals, the major change occurred with the magnesium specimen which underwent a net weight loss of 0.14 mg/cm². Out of a total of 36 specimens processed, this was the only effect of significance. It should be stated, however, that none of the metals used in this study showed visible evidence of carbonaceous deposits. Had such deposits been present, it is expected that the effect of electrocleaning would have been more pronounced.

B. Effect of Condensate Return

Several of the submitted lubricants were investigated using a condensate return glassware apparatus in order to determine the effect of refluxing of condensable effluent vapors. All runs with this procedure were conducted at 385°F with all other conditions unchanged from those tests performed with nonreflux. Attention is particularly called to the test air flow rate of 130 liters/hour which was used in both reflux and nonreflux tests. As a consequence of the relatively high air flow used, condensation efficiency is very low. Thus, only slight refluxing was actually obtained when using the condensate return configuration. This fact is substantiated by oil loss data which indicate little or no difference in sample weight loss between reflux and nonreflux tests on the test fluids at 385°F.

TABLE 6. SIGNIFICANT METAL SPECIMEN DEPOSITS

4

Oil	Significant Weight Gain for Test at				
Code	350°F	375°F	385°F	390°F	400°F
0-60-8	None	Steel	None	None	None
O-60-18	Steel	All	All	All less Cu	All less Cu
0-61-11	None	Ag, Cu, Mg	Ag, Cu	Cu	All less Ti, steel
0-62-13		None	None	None	Ti
0-64-2		Mone	None	None	Steel
0-64-12		Mg	All less Cu	Al, Ti, Mg	All less Cu
0-64-16			None	All	Al, Ti,
0-65-27			Mg		Ag

Significant weight gain, as used here, is defined as a specimen weight gain of 0,20 mg/cm² cr more.

Oxidation-corrosion test data are given in Table 7 on the effect of condensate return. Viscosity and neutralization number results are compared for both test methods. A large majority of the lubricants examined in this study were unaffected by the reflux procedure. However, some fluids showed a marked effect, and the technique served both to improve or worsen performance depending on oil type. Lubricants O-62-4, O-62-6, O-65-18, O-65-27, and O-65-28 showed increased oxidative stability when run with the reflux procedure. The use of condensate return had a deleterious effect on the performance of O-62-16 and O-65-21. For all lubricants mentioned, the effect was consistently reflected by the sample properties of viscosity and acidity. A seemingly unusual phenomenon, however, was indicated for O-65-19. Viscosity data for this oil showed no effect for refluxing. Sample neutralization number, however, gave almost an eightfold increase in the reflux determination. This result is assumed to be a unique characteristic of the lubricant.

It is interesting to note that of the six MIL-L-23699 type lubricants included in this work none was affected by the reflux method. All of the lubricants which were one way or another susceptible to vapor refluxing were of the MIL-L-7808 type.

Metal specimen corrosion data in the reflux determinations were generally unchanged from the results shown in nonreflux tests, but with two exceptions. Lubricant O-65-21, which gave no significant metal attack in nonreflux oxidation-corrosion tests, showed weight losses of 0.27 and 0.73 mg/cm² for copper and magnesium, respectively. The lubricant was of the group which likewise showed increased deterioration of oil properties using condensate return. Similarly, O-65-28 indicated a copper weight loss of -0.40 mg/cm² in the reflux test, but the metal was unaffected using the nonreflux procedure.

C. Results on Lubricant Blends

At the direction of AFAPL, six lubricant blends were prepared and evaluated in exidation-corrosion tests under specified conditions. The blends consisted of equal parts by volume of selected lubricants previously examined in the program. Two of the mixtures, J-1003 and J-1007, were composed of MIL-L-7808 type lubricants while the other four were blends of MIL-L-23699 type lubricants (Table 1).

Table 8 presents viscosity increase results on the oil mixtures. The blends are grouped in the table with their respective constituent oils. In general, no unusual effects were noted in this work. The 375°F test results on J-1003 showed no deleterious effect attributable to any incompatibility of the three constituents. In fact, viscosity data for the blend were very close to the arithmetical average of results obtained with the individual oils. The performance of J-1003 was further investigated by a test employing moist

TABLE 7. OXIDATION-CORROSION TEST RESULTS ON THE EFFECT OF CONDENSATE RETURN AT 385°F

Ccde Nonreflux Reflux Nonreflux Reflux O-62-3 72 71(a) 1.21 1.10(a) O-62-4 107(a) 79 1.70(a) 1.14 O-62-6 122(b) 54(a) 8.75(b) 7.90(a) O-62-16 70 110 13.96 21.9 O-63-16 170 153 1.14 1.17 O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 9.41 9.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 G-65-5 31 32	OH	100°F Vis Increa	ise, % at 48 hr	48-hr NN, n	ng KOH/g
O-62-4 107(a) 79 1.70(a) 1.14 O-62-6 122(b) 54(a) 8.75(b) 7.90(a) O-62-16 70 110 13.96 21.9 O-63-16 170 153 1.14 1.17 O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-6 8(a) 8 0.21(a) 0.21 O-65-14 577 452 2c.9<	Ccde	Nonreflux	Reflux	Novreflux	Reflux
O-62-4 107(a) 79 1.70(a) 1.14 O-62-6 122(b) 54(a) 8.75(b) 7.90(a) O-62-16 70 110 13.96 21.9 O-63-16 170 153 1.14 1.17 O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-6 8(a) 8 0.21(a) 0.21 O-65-14 577 452 2c.9<	0 (2 2		ms da l)
O-62-6 122(b) 54(a) 8.75(b) 7.90(a) O-62-16 70 110 13.96 21.9 O-63-16 170 153 1.14 1.17 O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 2c.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54					
O-62-16 70 110 13.96 21.9 O-63-16 170 153 1.14 1.17 O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-6 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0				1.70(a)	
O-63-16 170 153 1.14 1.17 O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 2C.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 0.54 0.59 O-65-15 16 16 0.54 0.59					
O-64-2 19 18 0.38 0.31 O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-15 16 16 0.54 0.59 <t< td=""><td></td><td></td><td></td><td>·</td><td></td></t<>				·	
O-64-13 24 23 0.10 0.04 O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 3.41 9.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 G-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 <					
O-64-22 10 10 0.41 0.46 O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 G-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-17 59 48 1.29 10.49 O-65-23 141 148 0.84 0.86		19	18	0.38	0.31
O-64-25 11 10(a) 0.15 0.15(a) O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-19 59 48 1.29 10.49 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-61-28 12,650 6559 21.8 18.75 <	0-64-13	24	23	0.10	0.04
O-64-26 109 106 0.41 0.47 O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 G-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 2c.9 30.7 O-65-15 16 16 0.45 0.45 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 10.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62	0-64-22	10		0.41	
O-65-1 532 639 26.2 29.2 O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-15 16 16 0.54 0.59 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 16.49 O-65-21 76 174 1.25 26.4 Q-65-23 141 148 0.84 0.86 Q-65-24 34 30 0.64 0.62 Q-65-27 1768 226 3.48 2.27 Q-65-28 12,650 6559 21.8 18.75 <td>0-64-25</td> <td>11</td> <td>10(a)</td> <td>0.15</td> <td>$0.15^{(a)}$</td>	0-64-25	11	10(a)	0.15	$0.15^{(a)}$
O-65-2 50 51 0.09 0.06 O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 2c.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 16.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-61-28 12,650 6559 21.8 18.75	0-64-26	109	106	9.41	9.47
O-65-3 319 271 2.01 1.83 O-65-4 16 15 0.50 0.45 G-65-5 31 32 0.30 0.31 O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 10.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-63-28 12,650 6559 21.8 18.75	0-65-1	532	639	26.2	29. 2
O-65-4 16 15 0.50 0.45 O-65-5 31 32 0.30 0.31 D-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 10.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-65-28 12,650 6559 21.8 18.75	0-65-2	50	51	0.09	0.06
G-65-5 31 32 0.30 0.31 D-65-8 8(a) 8 0.21(a) 0.21 D-65-14 577 452 20.9 30.7 D-65-15 16 16 0.45 0.45 D-65-16 16 16 0.54 0.59 D-65-18 148 129 1.85 1.68 D-65-19 59 48 1.29 10.49 D-65-21 76 174 1.25 26.4 D-65-23 141 148 0.84 0.86 D-65-24 34 30 0.64 0.62 D-65-27 1768 226 3.48 2.27 D-61-28 12,650 6559 21.8 18.75	Q-65-3	319	271	2.01	1.83
O-65-8 8(a) 8 0.21(a) 0.21 O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 10.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-61-28 12,650 6559 21.8 18.75	0-65-4	16	15	0.50	0.45
O-65-14 577 452 20.9 30.7 O-65-15 16 16 0.45 0.45 O-65-16 16 16 0.54 0.59 O-65-18 148 129 1.85 1.68 O-65-19 59 48 1.29 10.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-65-28 12,650 6559 21.8 18.75	O-65-5	31	32	0.30	0.31
O=65-15 16 16 0.45 0.45 O=65-16 16 16 0.54 0.59 O=65-18 148 129 1.85 1.68 O=65-19 59 48 1.29 10.49 O=65-21 76 174 1.25 26.4 O=65-23 141 148 0.84 0.86 O=65-24 34 30 0.64 0.62 O=65-27 1768 226 3.48 2.27 O=63-28 12,650 6559 21.8 18.75	0-65-8	g(a)	8	0. 21(a)	0.21
O=65-15 16 16 0.45 0.45 O=65-16 16 16 0.54 0.59 O=65-18 148 129 1.85 1.68 O=65-19 59 48 1.29 10.49 O=65-21 76 174 1.25 26.4 O=65-23 141 148 0.84 0.86 O=65-24 34 30 0.64 0.62 O=65-27 1768 226 3.48 2.27 O=63-28 12,650 6559 21.8 18.75	0-65-14	577	452	28.9	30. 7
C-65-18 148 129 1.85 1.68 C-65-19 59 48 1.29 10.49 C-65-21 76 174 1.25 26.4 C-65-23 141 148 0.84 0.86 C-65-24 34 30 0.64 0.62 C-65-27 1768 226 3.48 2.27 C-65-28 12,650 6559 21.8 18.75	0-65-15	16	16		0.45
O-65-19 59 48 1.29 16.49 O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-63-28 12,650 6559 21.8 18.75	O. 65-16	16	16	0.54	0.59
O-65-21 76 174 1.25 26.4 O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-63-28 12,650 6559 21.8 18.75	0-65-18	148	129	1.85	1.68
Q-65-21 76 174 1.25 26.4 Q-65-23 141 148 0.84 0.86 Q-65-24 34 30 0.64 0.62 Q-65-27 1768 226 3.48 2.27 Q-63-28 12,650 6559 21.8 18.75	0-65-19	59	48	1.29	16.49
O-65-23 141 148 0.84 0.86 O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-63-28 12,650 6559 21.8 18.75	0-65-21	76	174		26.4
O-65-24 34 30 0.64 0.62 O-65-27 1768 226 3.48 2.27 O-63-28 12,650 6559 21.8 18.75	Q-65-23	141	148	0.84	0.86
O-65-27 1768 226 3.48 2.27 O-63-28 12,650 6559 21.8 18.75	0-65-24		30		
O-61-28 12,650 6559 21.8 18.75					
			· ·		

⁽a) Average of duplicate determinations.

⁽b) Average of triplicate determinations.

TABLE 8. VISCOSITY INCREASE DATA ON LUBRICANT BLENDS AND BLEND CONSTITUENTS

100°F Vis Increase, %, for Test at 375°F, 385° F Oil Code Nonreflux Nonreflux Reflux 65-L-114 27 65-L-115 **]** : 55-L-116 17 J-1003 23 21(a) J-1003 72(c) 0-62-3 72 122(b) 54(c) 0-62-6 J-1007 96 84(c) 0-64-13 24 23 10(c) 0-64-25 11 J-1011 18 19 0-64-2 18 0-64-1323 19 J-1020 0-64-2 18 10(c) 0-64-25 J-1021 14 0-64-2 18 0-64-13 23 10(c)0-64-25 J-1025 15

⁽a) Test performed with water-saturated air.

⁽b) Average of triple ate determinations.

⁽c) Average of duplicate determinations.

air, rather than dry air as normally used. The air was passed through a diffuser stone submerged in distilled water prior to entering the test tube. The results of this run, however, did not differ in any aspect from those obtained in the dry air test. The trend exhibited by J-1003 was characteristic of all other blends except for J-1007. The nonreflux determination on this mixture demonstrated the expected effect, i.e., blend performance was rated between that of its constituents. In contrast, the J-1007 run with condensate return indicated a slight adverse effect, i.e., viscosity increase indicated a level of degradation more severe than that obtained for either of the two constituents. This effect is not considered to be too significant, however, as the value obtained for the blend was well within the repeatability variation of the constituent lubricant O-62-3.

Neutralization number data are given in Table 9 for the tests performed on the lubricant mixtures. These results confirmed the effects demonstrated by viscosity with the exception of blend J-1007. The blend acidity value, in both reflux and nonreflux tests, was very close to that for the lower of the two constituents, viz., O-62-3. In the case of the reflux test, this effect is in direct contradiction with the deterioration profile shown by viscosity data for J-1007.

Metal specimen data obtained in the blend experiments showed no evidence of lubricant incompatibility with respect to metal attack. In other words, none of the lubricant blends indicated metal corrosion which had not been previously noted for one of the blend constituents. The results do, however, provide an indication of the predominating influence of the individual lubricants. J-1003, for example, showed no evidence of metal corrosion at 375°F although one of its constitutents, 65-L-115, gave significant copper corrosion. Similarly, J-1007 indicated no specimen attack with or without refluxing, whereas O-62-6 corroded copper. Significant metal corrosion for the MIL-L-23699 blends is given here for the 385°F reflux determinations:

	Constituen	t Oils		Blende	ed Oils	
0-64-2	0-64-13	0-64-25	J-1011	J-1020	J-1021	J-1025
	Cu.	None	Cu			
None	Cu			None		
None		None			None	
None	Cu	None				None

Lubricant O-64-13 exhibited the predominating effect in the J-1011 blend since both tests showed copper corrosion, although O-64-25 aid not when tested singly. Similar performance was observed in the nonreflux tests on these fluids. When O-64-13 was blended with O-64-2, however, the resultant mixture did not give copper attack in the oxidation-corrosion test. Further, an equal-part mixture (J-1025) of all three lubricants likewise showed no metal corrosion.

TABLE 9. NEUTRALIZATION NUMBER DATA ON LUBRICANT BLENDS AND BLEND CONSTITUENTS

Oil	375°F,	N, mg KOH/g, for To 385°	
Code	Nonreflux	Nonreflux	Reflux
65-L-114	0.83		
65-L-115	0. 43		
65-L-116	0.98		
J-1003	0.84		
J-1003	0. 89(a)		
0-62-3		1.21	1.10(c)
0-62-6		8.75(b)	7.90(c)
J-1007		1.47	1.34(c)
0-64-13		0.10	0.04
O-64-25		0.15	0.15(c)
J-1011		0.08	0.11
0-64-2			0.31
0-64-13			0.04
J-1020			0.15
0-64-2			0.31
O-64-25			0.15(c)
J-1021			0.29
0-64-2			0.31
0-64-13			0.0-*
0-64-25			0.15(c)

J-1025

0.17

⁽a) Test performed with water-saturated air.

⁽b) Average of triplicate determinations.

⁽c) Average of duplicate determinations.

SECTION V

CONCLUSIONS

Using a 48-hour nonreflux oxidation-corrosion test procedure, 46 test lubricants were evaluated at one or more temperatures within the range of 350 to 400°F. Relatively mild oxidative degradation occurred at 350 and 375°F. At 400°F, lubricant deterioration was very severe with only four out of 16 of the lubricants tested giving satisfactory performance. Consequently, the major testing effort was confined to the temperatures of 385 and 390°F. The 385°F series indicated 23 satisfactory lubricants out of 37 examined. At 390°F, 16 lubricants passed from among a total of 29 tested.

Several duplicate determinations were made to verify the repeatability of the test procedure. The agreement of data was good in all cases except at very high levels of lubricant deterioration, where wide variability of data is normally anticipated.

Metal specimen condition in the nonreflux determinations indicated corrosion almost exclusively of copper and magnesium with several oils. The severity and frequency of attack increased with increasing test temperature. Similarly, the occurrence of specimen deposits was more frequently noted at the higher temperatures investigated. In the latter case, however, all metal types were susceptible to deposit formation. A cursory study to evaluate the applicability of a specimen electrocleaning technique showed essentially no difference for metal weight data. It is felt that a more significant effect would have been obtained on specimens which sustained visible deposits.

Results on the effect of condensate return at 385°F revealed that a large majority of the 19 lubricants tested were unaffected. Lubricants O-62-4 and O-62-6, however, showed improved performance in reflux tests, whereas O-62-16 and O-65-21 were less stable. Lubricant O-65-19 indicated no change in viscosity data between the reflux and nonreflux runs, but gave a substantially higher neutralization number in the reflux determination. None of the MIL-L-23699 type fluids was affected by vapor refluxing.

Six lubricant blends incorporating various combinations of eight individual lubricants were examined in this work. Oxidation-corrosion test results indicated no significant incompatibility of lubricant constituents. Blend J-1007 (mixture of O-62-3 and O-62-6) in a vapor reflux test indicated a slight adverse effect in that the deterioration, as noted by viscosity increase, was more severe than that of either of its constitutents. However, this effect is not considered to be conclusive since the value obtained for the blend was within the repeatability range of the constituent lubricant O-62-3. Sample neutralization number of this blend followed that of O-62-3, the lower acidity value of the two constituents.

APPENDIX DETAILED OXIDATION-CORROSION TEST DATA

TABLE 10. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-8 at 350°F

Sample Data

	'is,	100°F Vis Increase, %	Vis, cs/210°F	Neut, Nc., mg KOH/g	Overhead O	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	20.12 20.06 20.38 20.38	7.8 12.0 26.4 40.3	4.20 4.29 4.62 5.08	0.18 0.38 0.36 0.36	18.8 27.6 45.5 53.5	34	0.73	9.60
fetal Spe	Metal Specim in Data			ΗÌ	Test Cell Data			
Weight	Weight change, mg/cm²;	g/cm ² : Al Ti Ag	+0.02 -0.06 0.0	0	Sludge in oil:	200-m	200-mesh filter Centrifuge	None Trace
		Steel Cu Mg		05 05 06	Tube deposits:	•	Below oil level At and above oil level	None
Metal o	ital discoloration, d pitting, or etching:	lepos	OZ.		Test Conditions			
,	i.	Ti Ag Steel Cu Mg	ដដធីដ	n sllow reen C	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return		e [ri	350 200 130 No

TABLE 11. RESULTS OF NONREFLUX OXIDATION-CORROSICN TEST ON 0-60-8 AT 375°F

Sample Data

Overhead Sample Acidity, Vig, mg KOH/g cs/100°F	, 0.90 9.65		nesh filter None Centrifuge Trace	Below oil level At and above oil level None		375 200 130 No
1 8	52 0	ita	200-1	• •	ions	Sample temperature, *F Sample volume, mi Air rate, liter/hr Condensate return
S Wt, g wt %	30.6 46.2 75.2 88.0	Test Cell Data	Sludge in Oil:	Tube deposits:	Test Conditions	Sample (Sample Air rate Condens
Neut. No.,	0.18 0.50 0.54 0.65 1.08			e V		> e i
Vis,	4, 20 4, 58 4, 94 6, 44			+0.20 +0.0 +0.16	NG	Lt tan Lt yellow Dark blue NC NC
100°F Vis Increase, %	11.7 22.5 71.2 145		/cm ² : Al Ti	Steel Cu Mg	n, deposits,	
Vis, cs/100°E	16.12 18.01 19.75 27.60 39.43	Inen Data	Weight shange, mg/cm ² :		Metal discoloration, deposits, pitting, or etching:	.
	Initial 16 hr(² 24 hr 40 hr 48 hr	Metal Specimen Data	Weight		Metal o	•

(a) A gradual 5°F drop in bath temperature occurred during the test period of approximately 4 to 16 hr.

TABLE 12. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-8 AT 385°F

Sample Data

•							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
Initial	16.12	3 8	4.20	0.18	đ 1			
16 hr	18.89	17.2	4.80	0.45	42.1			
24 hr	21.74	34.9	5.34	0.59	63.0			
40 hr	41.29	156	8.71	1,13	9.96			
48 hr	79.03	390	14.29	1.67	101.3	09	1.14	99.6
Metal Spe	Metal Specimen Datz	•		Ĥ	Test Cell Data	аl		
Weight	Weight change, mg/cm ² :			27 47	Sludge in oil:	200-n	200-mesh filter Centrifuge	None (a)
		Ag Steel		9 8	Tube deposits: Below oil level	its: Belov	v oil level	None
		n O	-0.08	80	ı	At an	At and above oil level	evel None
·		Mg	+0.02	20				
Metal	discolorati	Metal discoloration, deposits,		H	Test Conditions	រាន		
pitti	pitting, or etching:	ning: Al	S					1
	ì	Ti	Brown		Sample temperature,	perature,	e Izq	385
		Ag	Lt yellow	low	Sample Volume, ml	ume, ml		200
		Stee	el Blue-green	green	Air rate, liter/hr	iter/hr		130
		Ca	Lt pink	*	Condensate return	return		°2
		Mg	N	O				

(a) Insufficient sample.

TABLE 13. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-8 at 390°F

Sample Data

Sample Vis, cs/100°F	9,68		None (a)	None level None	390 200 130 No
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.39		200-mesh filter Centrifuge	Below oil level At and above oil level	, মৈ
Oil Loss, wt %	65	ıta			Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	50.8 75.9 105.4 106.1	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample tempe Sample volum Air rate, lite Condensate re
Neut. No., mg KOH/g	0.18 0.54 0.73 1.67 1.68	H	-0.06 0.0	+0.02 0.0 -0.26 0.0	reen
Vis, cs/210°E	4.20 4.90 5.70 11.40		ŞΟ		NC Brown Yellow el Blue-g
100°F Vis Increase, %	22.0 47.6 273 482	-1	1g/cm ² : Al	Ag Steel Cu Mg	leposits, Al Ti Ag Ste Cu
Vis,	16.12 19.66 23.80 60.06 93.87	Metal Specimen Data	Weight change, mg/cm ² :	٨	tal discoloration, d pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spe	Weight		Metal pitt

(a) Insufficient sample.

TABLE 14. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-8 AT 400°F

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss,	Overhead Sample Acidity, Vis. mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	16.12 19.97 31.78 (a)	23.9 97.1	4.20 4.98 6.35	0.18 0.91 18.35 25.4	57.7 91.4 113.3	go kee min		
48 hr Metal Spe	48 hr Metal Specimen Data	;	;	Test (Test Cell Data	11	10.44	69.6
Weight	Weight change, mg/cm ² :		+0.04 -0.02 +0.10		Sludge in oil:	200-mesh filter Centrifuge	nesh filter Centrifuge	(a)
		Steel Cu Mg	+0.02 -7.6 -0.34		Tube Deposits:		Below oil level At and above oil level	Med var 1 Med var
Metal o	ital discoloration, c pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al	NC Lt blue	Test (Test Conditions	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)		6
		Ag Steel Cu Mg	NC Blue-green Severe etching Slight pitting		Sample Volume, ml Air rate, liter/hr Condensate return		r	200 200 130 No

(a) Test terminated at 40 hr, sample gelled.

TABLE 15, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-18 AT 350°F

Sample Vis, cs/100°F	10,75	None 0.10 m1/25 Med var None	
Overhead Sampla Acidity, Vis, mg KOH/g cs/100	1.36	level	350 200 130 No
Oil Loss,	23	200-mesh filter Centrifuge Below oil level At and above oil	ture, °F , ml hr irn
Overhead Wt, g	13.6 19.3 31.0 36.5	Sludge in oi': Tube deposits:	Sample temperature, Sample volume, ml nir rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.19 0.30 0.36 19. 0.40 31. 0.42 36.	Shuđ Tub	17 e 8
Vis, cs/210°F	3.27 3.27 3.45 4.65	+0.12 +0.14 +0.04 +0.26 +0.26	Lt brown Lt tan Lt yellow Hvy v irnish Lt brown Grey
100°F Vis Increase, %	. 4.7 9.8 9.8 9.6	n ² : Al Ti Ag Steel Cu Mg	eposits, Al Ti Ag Steel Cu
Vis, cs/100°E	12.13 12.73 13.03 13.32 13.30	Weight change, mg/cm2;	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Ag Stee
	Initial 12.1 16 hr 12.7 24 hr 13.0 40 hr 13.3 48 hr 13.3 Metal Specimen Data	Weight of	Metal dis pitting,

TABLE 16. RECELTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-18 AT 375°F

Sample Data

	;			i de la companya de l		1 1 E E E	Overhea	Overhead Sample
	Vis, cs/100°F	Increase, %	V18, C8/210°F	mg KOH/g	Wt, 8	wt%	mg KOH/g	3
Initial	12,13	l i	3.17	0.19	;			
16 hr(a)	13,08	°0°	3,36	0.56	22.9			
24 hr	13.21	8.9	3.44	0.61	33.9			
40 hr	14.08	16.1	3,55	0,61	55.2			
48 hr	13.92	14.8	3,51	0.73	65.0	39	1.81	11.00
Metal Specime Data	E. Data			Test Cell Data	Data			
Weight chi	Weight change, mg/cm2:		+0.26	Sludg	Sludge in oil:	200-mesh filter	lter	None
))	Ti	+0.24	•		Centrifuge	agnj	0,05 ml/25
		Ag	+0.26					
		Steel	+0,36	Tube	Tube deposits:	Below oil 'evel	vel	Med carbon
		លី	+0.20			At and above	e oil level	At and above oil level Med carbon
		148	+0,45					
Metal disc	Metal discoloration, deposits,	leposits,		Test Conditions	ditions			
pitting,	pitting, or etching:	¥	Lt brown					
)	Ti	Tan	Samp	Sample cemperature,	ure, 'F	375	
		Ag	Lt carbon		Sample volume, ml	ml	200	
		Steel	Hvy varnish		Air rate, liter/hr	1.	130	
		Çn	Lt varnish		Condensate return	rn	°Z	
		Mg	Lt carbon					
)						

⁽a) A gradual 5°F drop in bath temperature occurred during the test period of approximately 4 to 16 hr.

TABLE 17. RESULTS OF NOVREFLUX OXIDATION-CORROSION TEST ON O-60-18 AT 385°F

Sample Vis, cs/100° F	11.21		None 1.00 ml/25	Lt carbon Lt carbon	385 200 130 No
Overnead Sample Acidity, Vis, mg KOH/g cs/100	2.33			l level	ଳର୍⊣ Z
Oil Loss, wt %	90		200-mesh filter Centrifuge		ature, °F ;, ml /hr wrn
Overhead Wt, g	31.2 46.5 73.8 85.0	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.19 0.65 0.72 0.93	Test C			Tes
Vis, cs/210°F	3.17 3.48 3.52 3.63		+0.22 +0.22 +0.24		Med carbon Med carbon Med carbon Med carbon Med carbon Med carbon
100°F Vis Increase, % c	11.0 13.1 19.7 25.2		/cm ² : Al Ti Ag	Steel Cu Mg	n, deposits, ng: Ti Ag Ag Steel Cu
Vis, cs/100°E	12.13 13.47 13.72 14.52 15.19	imen Data	Weight change, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Al Aighting St. Ai
	Initial 16 hr 24 hr 40 hr	Metal Specimen Data	Weight		Metal d pittin

TABLE 18. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-50-18 AT 390°F

Sample Vis. cs/100°F	11.35		None 1.95 ml/25	Lt carbon Lt carbon	390 200 130 No
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.94		nesh filter Centrifuge	Below oil level At and above oil level	
Oil Loss, wt %	κ. 80		200-niesh filter Centrifuge		ature, °F , ml /hr :urn
Overhead Wt, g	39.5 57.3 88.8 99.5	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH, g	0.11 0.77 0.76 1.17 1.65	Test C			9
Vis, cs/210°F	3.17 3.52 3.49 3.75 3.98			+0.26 +0.24 +0.30	Med carbon N. 2 carbon Med carbon Med carbon Med carbon
100°F Vis Increase, %	13.7 17.7 29.7 50.9,		(/cm ² ; Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, all sitting, or etching: Al Ti Ag Ag Ag Ag Mg
Vis. cs/100°F	12.13 13.79 14.28 15.73 18.31,	Metal pecimen Data	Weight change, mg/cm ² :		etal discoloration, sitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal pec	Weight		Metal c

(a) Value obtained after centrifuging sample.

TABLE 19. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-18 AT 390°F

Sample Date

Oil Loss, Acidity, Vis, wt % mg KOH/g cs/100°F	55 2.73 11.23		200-mesh filter None Centrifuge 1.00 ml/25	Below oil level Lt carbon At and above oil level Lt carbon	ture, °F 390°F 200 hr
Neut, Nc., Overhead mg KOH/R Wt, g	0.19 0.74 37.2 0.91 54.8 1.20 86.6 1.64 99.1	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temperature, Sample Volume, ml Air rate, liter/hr
Vis, Ne	3.17 3.42 3.49 3.73		+0.10 +0.10 +0.14	+0.12 +0.10 +0.12	Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon
100°F Vis Increase, %	12.8 14.5 23.3 31.2		g/cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Ag
Vis, cs/100°F	12.13 13.68 13.87 14.96 15.91	imen Data	Weight change, mg/cm ² :		tal discoloration, d pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight		Metal d pittir

TABLE 20. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-18 AT 400°F

Sample Data

	Vis,	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhea Acidity, mg KOH/g	Overhead Sample Acidity, Vis, g KOH/g cs/100°F
Initial 16 hr 24 hr 40 hr 48 hr	12.13 13.78 13.97 16.61 (a)	13.6 15.2 36.9	3.17 3.51 3.53 4.03 (a)	0.19 1.02 1.14 2.09 (a)	46.1 67.6 104.2 114.8	99	2.99	11, 48
Metal Specimen Data	en Data			Test Cell Data	Data			
Weight ch	Weight change, mg/cm ² ;	ⁿ² : Ai Ti Ag	+0.67+0.53	Sludge	Sludge in oil: 2	200-mesh filter Centrifuge	ler ge	(a) (a)
		Steel Cu Mg	+0. 61 +0. 08 +0. 57	Tube o	Tube depositor 1	Below oil level At and above oil level	el oil level	Med carbon Med carbon
Metal dise	Metal discontation, deposits, pitting, or etching: Al Ti Ag Stee	=	Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon	Test Conditions Sample tem Sample volu Air rate, lit Condensate	c Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	ure, °F ml r n	400 200 130 No	

(a) Insufficient sample.

TABLE 21. RELULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-60-18 AT 400°F

Sample Data

Overhead Sample Acidity, Vis, g KOH/g cs/100°F	7. 40		(a) (a)	Med carbon Med carbon		400 200 130 No
Overhead Acidity, mg KOH/g	3.09		nesh filter Centrifuge	Below oil level At and above oil level		
Oil Loss, wt %	29		200-n			rature, °F e, ml /hr turn
Overhead Wt, g	46.8 67.4 103.3 113.0	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.19 0.98 1.20 1.86 (a)	Test C			•	, ,
Vis, cs/210°F	3.17 3.45 3.64 3.83 (a)		+0.45 +0.04 (b) +0.08 (b)	+0.34 +0.02 +0.49	Lt carbon	Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon
100°F Vis Increase, %	13.8		g/cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching:	
Vis, cs/100°F	12.13 13.80 14.45 16.91 (a)	Metal Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:	,
	Initial 16 hr 24 hr 40 hr	Metal Spe	Weight		Metal c	

⁽a) Insufficient sample.

⁽b) Weight error suspected.

TABLE 22. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON C-61-11 at 350°F

Sample Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
							A second filter property and the second seco	AND ASSESSMENT OF THE PROPERTY
Initfal	15.67	I ţ	4.11	0.39	1 1			
16 hr	16.51	5.4	4.29	0.82	14.3			
24 hr	16.98	8.4	4,38	0.85	20.5			
40 hr	17.92	14.4	4,58	0.84	32.7			
48 hr	18.68	19.2	4.79	0.83	38,2	28	1.90	10.63
Metal Spe	Metal Specimen Data			Te	Test Cell Data			
Weight	Weight change, mg/cm ² :	g/cm ² : A1	9	+0.10	Sludge in oil:		200-meth filter	None
			0	0.0			Centrifuge	Trace
		Ag	9	+0.18			•	
		Steel	9	+0.04	Tube deposits:		Below oil level	None
۷.		S.	9	+0.16			At and above oil level	evel None
	.•	Mg	9	. 16				
Metal (discoloratic	Metal discoloration, deposits,		Te	Test Conditions	so.		
pitti	pitting, or etching:	ing: Al	Brown			ı		
	٠	Ti	Lt blue	1e	Sample temperature,	nperature,	দি	350
		Ag	Brown	ď	Sample volume, ml	ume, ml		200
		Steel	Lt brown	own	Air rate, liter/hr	iter/hr		130
		Cu	Dark	Dark brown	Condensate return	return		No
		Mg	Brown	E .				

TABLE 23. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-61-11 AT 375°F

Sample Vis, cs/100°F	- L 0		None Trace	Lt var i Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100°	2,05		200-mesh filter Centrifuge	Below oil level At and above oil level	375 200 130 No
Oil Loss, wt %	4. E		200-me Ce		rature, °F s, ml //hr turn
Overhead O Wt, g	24.7 36.3 57.9 66.7	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KCH/g	0.39 0.90 0.90 0.76 0.85	Tes	•		T E
Vis, cs/210°E	4, 11 4, 52 4, 56 5, 14 5, 63		+0.12 +0.02 +0.37	+0.12 +0.30 +0.34	Brown Lt blue Lt carbon Peacock Lt carbon Hvy varnish
100°F Vis Increase, %	8.0 13.0 29.1 44.2			Steel Cu Mg	leposits, A1 Ti Ag Steel Cu Mg
Vis, cs/100°E	15.67 16.93 17.71 20.23 22.60	en Data	Weight change, mg/cm ² :		Metal discoloration, deposits, Pitting, or etching: Al Ti Ag Stee
	Initial 16 hr (a) 24 hr 40 hr 48 hr	Metal Specimen Data	Weight ch		Metal dise

(a) A gradual 5°F drop in bath temperature occurred during the test period of approximately 4 to $16~\mathrm{hr}$.

TABLE 24. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-61-11 AT 385°F

Sample Data

Vis,	11.08		None Trace	Lt var Lt var	
Sam V	proq pro		e e		10.00
Overhead Sample Acidity, Vis, mg KOH/g cs/100	2.03		200-mesh filter Centrifuge	Below oil level At and above oil level	*F 385 200 130 No
Oil Loss, wt %	\$2		200-r		
Overhead Wt, g	38.0 55.1 82.0 90.5	Test Cell Data	Sludge in cil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No.,	0.39 0.87 0.89 0.89	Test	<i>α</i>	r	Test
Vis, cs/210°F	4.11 4.80 5.99 8.19		+0.04 +0.06 +0.24	+0.02 +0.26 +6.12	Lt brown Lt green Brown Green-red Lt carbon Brown
100°F Vis	11.9 20.3 55.3 118		n ² : Aì Ti Ag	Steel Cu Mg	=
Vis, cs/100°F	15.67 17.54 18.85 24.34 34.21	nen Data	Weight change, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Al Ti Ag Stee
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight cl		Metal did

TABLE 25. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0.61-11 AT 385°F

.

Sample Vis, cs/100°F	10.98		None Trace	Lt var el Lk var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	2.29		260-mesh filter Centrifuge	Below all level Lt var At and above oil level Lt var	*F 385 200 130 No
Oil Loss,	09			• •	perature, me, ml er/hr return
Overhead Wt, g	35.2 51.2 78.3	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.39 0.91 0.91 1.17	Test	v	Н	TI S S S S S S S S S S S S S S S S S S S
Vis, cs/210°F	4, 47 4, 47 75, 75 7, 09		+0,08 +0,02 +0,02	+0, 47 +0, 26 +0, 12	Lt brown Lt green Brown Lt green Lt carbon Lt carbon
100 F Vis				Steel Cu Mg	ed.
Vis,	15,67 17,38 18,50 22,9.	nen Data	Weight change, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Al Ti Ag Stee
	Initial 16 hr 24 hz 40 hr 48 hr	Metal Specimen Data	Weight o		Metal dis

TABLE 26. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-61-11 AT 390°F

Sample Data

ample Vis, cs/100°F	11.25		None (a)	Lt var el Lt var	
Overhead Sample Acidity, Vis, rng KOH/g cs/100°F	2.05		200-mesh filter Centrifuge	Below oil level At and above oillevel	°F 390 200 130 No
Oil Loss,	62			•	perature, me, ml er/hr return
Overhead Wt, g	42.5 61.0 91.6	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut, No., mg KOH/g	0.39 6.91 0.98 1.13	Tes			Tes
Vis, cs/210°F	4.11 4.53 6.41 9.81		+0.08 0.0 +0.28	+0.04 +0.24 +0.08	Lt brown Lt blue Lt carbon Red-purple Lt carbon Brown
100°F Vis Increase, %	12.8 22.4 67.5		n ² : Al Ti Ag	Steel Cu Mg	•-
Vis, cs/100°F	15.67 17.67 19.18 26.25 42.51	ien Data	Weight change, mg/cm ² :		Metal discolo, ation, deposits, pitting, or etching: Ti Ag Stee
	Initial 16 Fr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight c		Metal dis pitting,

(a) Insufficient sample.

TABLE 27, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-61-11 AT 390*F

Sample Data

Sample Vis,	11.20		Nore (a) Lt var Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100*	2.40		200-mesh filter Centrifuge Below oil level At and above oil level	390 200 130 No
Oil Loss,	09		···	erature, °F ne, mi er/hr eturn
Overhead Wt, g	39.7 57.0 86.9 96.5	Test Cell Data	Sludge in oil: Tube deposits:	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.39 0.96 0.99 1.09 1.59	Test	Ø ₽	T e s S S S S S S S S S S S S S S S S S S
Vis,	4. 11 4. 79 6. 12 8. 72		+0. C4 -0. 04 -0. 22 -0. 04 +0. 20 +0. 08	Lt brown Lt blue Brown Blue-red Lt carbon
100°F Vis Increase, %	11.9 20.5 60.8 135		a ² : Al Ti Ag Steel Cu Mg	soud
Vis, cs/100°F	15.67 17.53 18.89 25.20 36.89	nen Data	Weight change, mg/cm ² :	Metal discoloration, deposits, pitting, or etching: Ti Ag Stee
	Initial 16 hr 24 hr 40 hr	Metal Specimen Data	Weight cl	Metal dis

(a) Insufficient sample.

TABLE 28. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-61-11 AT 400 F

Sample Data

Sample Vis, cs/100°F	11.37		(a) (a)	Lt var	•
Overhead Sample Acidity, Vis, mg KOH/g cs/100*	2.46		200-mesh filter Centrifuge	Below oil level At and above oil level	400 200 130 No
Oil Loss,	89		200-r		erature, °I ne, ml er/hr eturn
Overhead (Wt, 8	47.9 68.9 103.0 111.8	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temperature, *F Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.39 1.06 1.14 1.71 (a)	Te	Ç; &;	4 . ó	T e
Vis,	4.11 4.57 4.49 6.93		+0.20 0.0 +0.28	0.0 +0.34 +0.20	Lt brown Lt blue Lt carbon Peacock Lt carbon Brown
100°F 1 is Increase, %	3.1 24.1 82.2		/cm ² : Al Ti Ag	Steel Cu Mg	g: deposits, g: Al Ti Ag Steel Cu Mg
Vis, cs/100°F	15.67 17 73 19.44 28.56 (a)	Metal Specimer Data	Weight change, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Ti Ag Ste
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Medal d pittin

(a) Insufficient sample.

TABLE 29. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-3 AT 350°F

ample Data

Sample Vis, cs/100°F	8.79		None	None	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.14		200-mesh filter Centrifuge	Below oil level At and above oil level	*F 350 200 130 No
Oil Loss, wt %	23		200-r	its: Below At and	erature, ne, ml er/hr eturn
Overhead Wt, g	12.7 17.9 26.7 30.6	Test Cell Data	Sludge in oil:	Tube de posits: Below oil level At and above oi	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.02 0.27 0.36 0.44 0.52	T)6)2))6 10	low wn
Vis, cs/210°F	3.84 4.12 1.12 4.38 4.54		+0.06 +0.02 0.0	+0.06 -0.08 +0.10	NC Lt tan Lt yellow Lt brown Lt tan
Increase, %	7.2 10.8 19.7 25.6			Steel Cu Mg	i, deposits, ig: Al Ti Ag Ag Steel Cu Mg
Vis, cs/100°F	15.51 16.63 17.18 18.57 19.48	imen Data	Weight change, mg/cm2;		Metal discoloration, deposits, pitting, or etching: Ti Ag Stel
	Initial 16 hr 24 hr 40 hr	Metal Specimen Data	Weight		Metal d pittin

TABLE 30. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-3 AI 375°F

Sample Data

16 hr (a) 16.85 8.6 4.05 0.2 24 hr 17.78 14.6 4.22 0.4 40 hr 20.68 33.3 4.70 0.6 48 hr 22.87 47.5 5.06 0.6 tal Specimen Data Weight change, mg/cm ² : Al -0.02 Ti -0.04 Ag +0.08 Steel +0.08 Cu -0.14 Mg 0.0 Metal discoloration, deposits, pitting, cr etching: Al Lt yellow Ti Lt brown As tables	0.48 9.5 0.57 18.8 0.69 37.0 0.86 43.3 Test Cell Data Sludge in oil:	34 1,38 200-mesh filter Centrifuge	8.97 None
4. 22 4. 70 5. 06 -0. 02 -0. 04 +0. 08 +0. 08 -0. 14 0. 0 Lt yellow Lt brown Lt brown	Fe	34 200-r	8.97 None
4.70 5.06 -0.02 -0.04 +0.08 +0.08 -0.14 0.0 Lt yellow Lt brown Lt brown	Te	34 200-r	8.97 None
5.06 -0.02 -0.04 +0.08 -0.14 -0.14 0.0 Lt yellow Lt brown Lt brown	He	34 200-n	8.97 None
e]	Test Cell Data Sludge in oil	200-n	None
e J	Sludge in oil	200-n	None
e J		Centrange	
e1			None
	Tube deposits:	s: Below oil level	None
		At and above oil level	vei None
	Test Conditions		
	Sample temperature,	ম	
	Sample volume, ml	ne, ml 200	
	Air rate, liter/hr		
Cu Brown	Condensate return	return No	
Me			

(a) A gradual > F drop in bath temperature occurred during the test period of approximately 4 to 16 hr.

TABLE 31. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-3 AT 385°F

Overhead Sample Acidity, s, mg KOH/g cs/100°F	000	,	None None	Lt var	385 200 130 Nc
	1.62		200-mesh fi ter Centri inge	Felow oil level At and above oil leve!	*F 385 200 130 No
Oil Loss,	4.2		200-r		erature, ne, ml :r/hr eturn
Overhead Wt, g	18.6 32.5 52.9 57.6	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.02 0.58 0.67 0.94 1.21	Te			∏ e
Vis, cs/210°F	3.84 4.15 5.42 5.64		+0.02 +0.02 0.0		NC Brown Lt yellow Blue Brown
100°F Vis Increase, %	12.6 22.2 50.9 72.3		//cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
Vis, Ce/100°F	15.51 17.46 18.95 23.40 26.72	Metal Specimen Data	Weight change, mg/cm ² ;		etal discoloration, pitting, or etching:
, , ,	40 hr 48 hr 48 hr 48 hr	Metal Spe	Weight		Metal d pittin

TABLE 32, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-62-3 AT 385°F

			None	None el None		ک 00 8 8
Oil Loss, wt%	€°		nesh filter Centrifuge	Below oil level At and above oil level None		385 200 130 Yes
Neut. No., mg KOH/g	0.02 0.53 0.65 1.08	11 Data	Sludge in oil: 200-mesh filter Centrifuge	Tube deposits: Below oil level At and above oi	Test Conditions	Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/120°F	3.84 4.16 4.32 5.10 5.59	Test Cell Data	Slud	Tube	Test Co	Sam Sam Air Con
100°F Vis Increase, %			+0, 10	0.0 +0.02 0.0 +0.06		Lt brown Brown Yellow Blue Purple Lt yellow
10 Inc				Ag Steel Cu Mg	posits,	Ti Ti Ağ Steel Cu Mg
Vis, cs/100°F	15.51 17.54 18.91 23.26 26.15	ø,	ge, mg/cm ²		loration, de	etching:
Sample Data	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight change, mg/cm2:		Metal discoloration, deposits,	pitting, or etching:

TABLE 33. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-62.3 AT 385°F

15.51
17, 61 19, 15 23, 57 26, 83
Weight change, mg/cm2; Al Ti
Ste Cu Mg
Metal discoloration, deposits, pitting, or etching:
Ti Ag Steel Cu Mg

TABLE 34. RESULTS OF NONREFLUX CXIDATION-CORROSION TEST ON O-62-3 AT 390"F

NC Brown NC Blue	el BB B	ت ت	rd rd

TABLE 35. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-62-3 AT 390°F

Sample Vis,	11.25		Mone None	Lt var 1 Lt var	0.00
Overhead Sample Acidity, Vis, mg KOH/g cs/100	2.05		200-mesh filter Centrifuge	Below vil level At and above oil level	590 200 130 No
Oil Loss, wt %	84		200-me Ce		rature, °F e, ml ./hr .urn
Overhead C	33.5 50.1 71.7 77.0	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.02 0.59 0.79 1.03	Tes			T
Vis, cs/210°F	3.84 4.27 4.55 5.35		+0.02	0.0 -0.22 +0.02	Lt tan Brown Yellow Blue Brown-red
Increase, %	16.4 28.4 63.9 87.2		//cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	15.51 18.06 19.92 25.42 29.03	imen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metai Specimen Data	Weight		Metal di pitting

TABLE 36. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-3 AT 400°F

Vis.	160°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead (Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
15.51 18.73 21.08 47.15	20.8 35.9 204 590	3.84 4.38 4.74 7.71	0.02 0.73 1.03 10.01	4. 8. 8. 8. 4. 8. 8. 8. 4. 8. 8. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4.	4.	5.27	9.19
Metal Specimen Data			Te	Test Cell Data			
E	Weight change, mg/cm ² : Al Ti	0,00	+0.12 +0.08 -0.04	Sludge in oil:	200-r	200-mesh filter Centrifuge	None None
	Steel Cu Mg		+0.02 -0.40 -0.22	Tube deposits:		Below oil level At and above oil level	Lt var el None
<u> </u>	Metal discoloration, deposits, pitting, or etching: Al	Z	NC Te	Test Conditions			
			Blue NC Green Slight etching Slight etching	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return		*F 460 200 130 No	9 9 9 o

TABLE 37. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-3 AT 400°F

Sample Data

	Vis, cs/190°F	100°F Vis	Vis, cs/210 ·F	Neut. No., mg KOH/g	Overhead Oil Loss. Wt, g wt %	Oil Loss.	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
initiai 16 hr	15.51 18.68	20.4	က် ရှင် တယ် (0.02	7.24			
24 hr 40 hz 48 hr	21, 2& 28. 95 44. 09	36.9 86.7 184	4,74 5,82 7,63	1, 00 2, 55 7, 27	61.4 83.0 86.3	55	2.34	9.21
Metal Spe	Metal Specimen Data			[+]	Test Cell Data	el		
Weight	Weight change, mg/cm ² :		9.08		Sludge in oil:		200-mesh filter Centrifuge	None
		Steel Cu Mg	+0.04 0.0(a) -0.02(a)	(a)	Tube deposits:		Below oil level At and above oil level	None evel None
Metal c	Metal discoloration, deposite, patting, or etching. Al	n, deposite, ng. Al	NC		Test Conditions	na		
			Blue NC Green		Sample temperatur Sample volume, ml Air rate, liter/hr	Sample temperature, Sample volume, ml Air rate, liter/hr	*F. 460 200 130	၁၈၀
		. Cu	Slight etchire Slight etching	tchire tching	Condensate zeturn	e return	N _C	

(a) Weight error suspected.

TABLE 38. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-4 AT 350°F

						1	Overhead Sample	Sample
	Vis, cs/100°F	Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overlead Oil Loss,	Oil Loss.	Acidity, mg KOH/g	Vis, cs/100°F
Initial	15.01	1 1	3.93	0.11	1 3			
16 hr	15.78	5.1	4.10	0.61	14.6			
24 hr	16.03	6.8	4.14	0.63	21.0			
40 hr	16.91	12.7	4.35	0.56	34.3			
40 hr	17.51	16.7	4,49	0.62	40.2	2.3	9.	10.65
Metal Spe	Metal Specimen Data			Test	Test Cell Data			
Weight	Weight change, mg/cm^2 :		99		Sludge in sil:	200-mesh filt ar Centrifug	nesh filtər Certrifug	None 0.10 ml/25
		Ag Ste		0.0 +0.06 T	Tube deposits:	: Below oil level	l lev sl	None
		ċ			ı		At and above oil lever	None
		Mg		0.				
Metal	discoloratio	Metal discoloration, deposits,		Tes	Test Conditions			
pitti	pitting, or etching:	ing: Al	Lt ye	Lt yellow				
i)		Lt tan		sample temperature,	rature, 'F	350	
		48		Lt yeliow S	Sample volume, ml	ie, ml	200	
		Steel		Red-brown	Air rate, ster/hr	r/hr	130	
		ວິດ	Lt bi	Lt brown (Condensate return	eturn	Z	
		Mg	NC					

TABLE 39. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-4 AT 375°F

Sample Data

	Vis,	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Acidity, mg KOH/g	Overhead Sample veidity, Vis, g KOH/g cs/100°F
Initial 16 hr(a) 24 hr 40 hr	15.01 16.09 16.75	7.2 11.6 25.3	3.93 4.15 4.29	0.11 0.84 0.82 0.95	24.1 35.7 55.4			
48 hr	21.51	43.3	5.37	1.23	68.4	42	1.66	10.85
Metal Specimen Data	nen Data			Test Cell Data	Data			
Weight ch	Weight change, mg/cm ² :	:m ² : Al Ti Ag	+0.02	Sludge	Sludge in oi!: 2	200-mesh filter Centrifuge		None 0.40 ml/25
		Steel Cu Mg	-0.04 0.08 +0.06	Tube d	Tube deposits: E	Below oil level At and above oil level	l level	None Lt var
Metal dis	Metal discoloration, deposits, pitting, or etching:	deposits,	بر م	Test Conditions	ditions			
			Lt brown Lt yellow Blue Lt brown	Sampl Sampl Air ra Conde	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	ure, °F ml ir fr	375 200 130 No	
		Mg	NC					

⁽a) A gradual 5°F drop in bath temperature occurred during the test period of approximately 4 to 15 hr.

TABLE 40. RESUITS OF NONR JFLUX OXIDATION-CORROSION TEST ON O-62-4 AT 385°F

Sample Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss,	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
Initial	15.01	;	3.93	0.11	!			
16 hr	16.48	8.6	4.24	0.88	34.9			
24 hr	17.41	16.0	4.17	0.82	51.9			
40 hr	21.73	44.8	4 52	0.99	84.1			
48 hr	30,22	101	75	1.45	9.96	58	1.68	11.06
Metal Spe	Metal Specimen Data			Tes	Test Cell Data			
Weight	Weight change, mg/cm ² :		+0.02		Sludge in oil:		200-mesh filler	None
1		T_{λ}	+0.02	2		ŭ	Centrifuge	(a)
		Ag		4				
		Steel	90.0+		Tube deposits:	s: Below oil level	il level	Lt var
		Cu	-0.04	4		At and a	At and above oil level	el Lt var
		Mg	+0.05	2				
Metal	discoloratio	Metal discoloration, deposits,		Tes	Test Conditions			
pitti	pitting, cr etching:	.ng: Al	Pink					
•)		Pink		Sample temperature,	crature, °F		385
		Ag	Lt pink		Sample volume, ml	ne, ml	00.2	0
		Steel			Air rate, liter/hr	er/hr		02
		Cn			Condensate return	eturn.	°N	0
		Mg	Tan	ı				

(a) Insufficient sample.

TABLE 41. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-62-4 AT 385°F

Sample Data

Vis.	46.98		None (a)	Lt var Lt var	
Overhead Sample Acidity, Vis. mg KOH/g cs/100°F	1.69		200-mesh filter Centrifuge	Below oil level At and above oil levei	*F 385 200 130 No
Oil Loss, wt %	35		7007-L		
Overhead Oil Loss, Wt, g wt %	34.2 50.5 81.1 92.5	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.11 0.84 0.90 1.26 1.95	Tes			E L
Vis, cs/210°F	3.93 4.26 4.45 5.43		+0.04 +0.02 +0.06	+0.06 -0.02 0.0	Lt pink Tan Lt pink Green Orange
100°F Vis Increase, %	9.7 15.5 45.1		y/cm ² : Al Ti Ag	îteel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	15.01 16.46 17.33 21.78 32.04	Metal Specimen Data	Weight change, mg/cm2;		pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spec	Weight		Metal d pitting

(a) Insufficient sample.

Oil Loss,

wt %

	TABLE 42.	RESULT	rs of reflux oxidati on 0-62-4 at 385°F	RESULTS OF REFLUX OXIDATION-CORROSICN TEST ON O-62-4 AT 385°F	CORROSICN	TEST
Sample Data						
	Vis.	10	100°F Vis	Vis,	Neut. No.,	., Oil L
	C8 1100 F	Inc	Increase, %	C8/210°F	mg KOH/g	B wt
Initial	15.01		\$ 6	3,93	0.39	
16 hr	16.43		9.5	4.24	0.86	
24 hr	17, 29		15, 2	4.37	0.86	
40 hr	20.80		38.6	5, 23	0,91	
48 hr	26.93		79.4	6.56	1.14	Ň
Metal Specimen Data	ata			Test Cell Data	Jata	
Weight cha	Weight change, mg/on 2;	ΑI	+0.04	Sludge in oil:		200-mesh filter
		Ţ	0.0			Centrifuge
		Αg	+0.02			
		Steel	0.0	Tube d	Tube deposits: Bel	Below oil level
		Cn	-0.04		At	At and above oil
		Mg	+0.04			level
Metal disc	Metal discoloration, deposits,	osita,		Test Conditions	tions	
pitting, c	or etching:	7.	Lt yellow			
		Ţ	Lt brown	Sample	Sample temperature,	e, • FF
		Ag	Lt yellow	Sample	Sample volume, mi	
		Steel	Green-blue	Air ra	Air rate, liter/hr	
		o C	Brown	Conder	Condensate return	
		Mg	Lt yellow			

Lt carbon

385 200 130 Yes

Med var

None Trace

54

TABLE 43. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-4 AT 390°F

Sample Data

Overhead Sample Acidity, Vis. g KOH/g cs/100°F) • •	None (a)	Lt var il Lt var	390 200 130 No
l* El		200-mesh filter Centrifuge	Below oil level At and above oil level	*F 39C 200 130 No
Oil Loss, wt %		200-r		a)
Overhead Wt, g 39.3 57.7 91.3	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g 0.11 0.81 1.05 1.19 2.22	Tes	0.0 -0.02 +0.02		r L
Vis, cs/210°F 3.93 4.20 4.54 5.91 11.39			v	
100°F Vis Increase, % 11.3 18.6 60.5 241		y/cm ² ; Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu Mg
Vis, cs/100°F 15.01 16.70 17.80 24.09 51.19	Metal Specimen Data	Weight change, mg/cm ² ;	æ	pitting, or etching;
Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal d pittin

(a) Insufficient sample.

TABLE 44. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-4 AT 400°F

Sample Data

Ly Cy	§*.nu		អ អ ស្ត្រី ស្ត្
Sample Vis, cs/100°F	Stand and probl		(a) (a) Med var Med var 00 00
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.94		Centrifuge Centrifuge Below oil level At and above oil level ture, °F 400 ml 200 hr No
Oil Loss,	4		or and a second
Overhead Wt, g	45.7 67.6 105.6	Test Cell Data	Sludge in oil: 200-n Tube deposits: Below At an Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.11 1.03 1.14 2.49 (a)	Test	0 0 0 0 02 34 34 06 06 wn wn ow C
Vis, cs/210°F	3.93 4.38 4.63 8.00 (a)		
100°F Vis Increase, %	111.7 20.6 128		Weight change, mg/cm ² : Al Ti Ag Steel Cu Mg Mg pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	15.01 16.76 18.10 34.22 (a)	Metal Specimen Data	Weight change, mg/cm ² : Metal discoloration, depo
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight Metal o

(a) Insufficient sample.

TABLE 45. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-6 AT 350°F

Sample Data

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Overhead C	Oil Loss, wt %	Overhead Sample Acidity, Vis, ing KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr 48 hr	17.79 18.58 19.17 20.68 21.87	4.4 7.8 16.2 22.9	4.70 4.86 5.01 5.31	0.24 0.53 0.55 0.56	15.0 21.9 35.3 41.4	82	 	10.54
Spe	Netal Specimen Data			T	Test Cell Data			
ight	Weight change, mg/cm ² :	g/cm ² : Al Ti Ag	+0.04 -0.02 -0.04	04 02 04 ·	Sludge in oil:	200 -r	200-mesh filter Centrifuge	None None
		Steel Cu Mg	000	+0.04 0.0 0.0	Tube deposits:		Below oil level At and above oil level	None vel None
tal (etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu	Lt yellow Lt tan Lt yellow Dark blue Lt green NC		Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	erature, ne, ml er/hr return	in E V - V	350 200 130 No

TABLE 46. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-6 AT 375°F

Sample Data

Total	d Oil Loss,	Overhead Sample
g/cm ² : Al +0.06 g/cm ² : Al +0.06 Ti -0.14 Ag 0.0 Steel -0.02 Cu +0.18 Mg +0.04 Thi Brown Ag Lt yellow Steel Blue Cu Yellow-green	Wt, g wtg mg KOH/g	CS
g/cm ² : Al	J	
g/cm ² : Al +0.06 g/cm ² : Al +0.06 Ti -0.14 Ag 0.0 Steel +0.18 Mg +0.04 The Brown Ag Lt yellow Steel Blue Cu Yellow-green	25.0	
38.1 6.20 0.77 5.66.7 7.32 0.90 g/cm ² : Al +0.06 Ti -0.14 Ag 0.0 Steel -0.02 Cu +0.18 Mg +0.04 Ing: Al Grey Ing: Al Brown Ag Lt yellow Steel Blue Cu Yellow-green	37.3	
g/cm ² : Al +0.06 g/cm ² : Al +0.06 Ti -0.14 Ag 0.0 Steel +0.18 Mg +0.18 hg +0.04 Ing: Al Grey Ing: Al Brown Ag Lt yellow Steel Blue Cu Yellow-green	60,8	
g/cm ² : Al +0.06 Ti -0.14 Ag 0.0 Steel -0.02 Cu +0.18 Mg +0.18 hg +0.04 Ing: Al Grey Ti Brown Ag Lt yellow Steel Blue Cu Yellow-green	70.7 42 1.67	10.69
+0.06 -0.14 0.0 -0.02 +0.18 +0.18 +0.04 Crey Brown Lt yellow el Blue Yellow-green	ata	
el -0.02 +0.18 +0.04 +0.04 Grey Brown Lt yellow el Blue Yellow-green	a oil: 200-mesh filter Centrifuge	None None
+0.18 +0.04 Grey Brown Lt yellow el Blue Yellow-green	Tube deposits: Below oil level	None
Grey Brown Lt yellow el Blue Yellow-green		
Al Grey Ti Brown Ag Lt yellow Steel Blue Cu Yellow-green	ions	
Lt yellow Blue Yellow-green NC	Sample temperature, °F	375
Blue Yellow-green NC	Sampie volume, ml	200
Yellow-green	Air rate, liter/hr	130
	Condensate return	No

(a) A gradual 5°F drop in sample temperature occurred during the test period of approximately 4 to 16 hr.

TABLE 47. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-6 AT 385°F

Sample Data

Overhead Sample Acidity, Vis, mg KOH/g cs/100°F	2.68 10.67		filter None ifuge Trace	Below oil level At and above oil level Lt var		385 200 130 No
Oil Loss, A	57 2	et I	il: 200-mesh filter Centrifuge		8u	nperature, °F ume, ml iter/hr e return
Overhead Wt, g	33.6 49.2 78.3 82.9	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.24 0.75 0.82 1.25 22.4	H	+0.04 +0.02	-0.02 -0.25 -0.10	N L	Blue IVC Lt green Slight etching Lt yellow
Vis, cs/210°F	4.70 5.07 5.42 6.49 7.43				, ,	
100°F Vis Increase, %	1.1 18.7 47.3 118			Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching:	
Vis, cs/100°F	17.79 17.99 21.12 26.21 38.79	Metal Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:	
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal c	

TABLE 48. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-62-6 AT 385°F

	Vis, cs/100°F	100°F Vis Incresse, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss, Wt, g wt %	Oil Loss,	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	17.79 19.97 21.76 29.28	12.3 22.3 64,6	4.70 5.15 5.58 7.19	0.24 0.74 0.79 1.19	37.0 54.0 84.0			
48 nr Metal Spec	48 nr 38.89 Metal Specimen Data	119	9.12	2.06	94.0 Test Ceil Data	57	2.41	10.94
Weight	Weight change, mg/cm ² :			+0.04 -0.02 +0.06	Sludge in oil:	200 -r	200-mesh filter Centrifuge	None Trace
		Steel Cu Mg		0.0 -0.14 -3.04	Tube deposits:		Below oil level At and above oil level Lt var	Lt var vel Lt var
Metal c	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al	Lt purple Dark purple		Test Conditions Sample temperature.	erature	ድ ማ	
		Ag Steel Cu Mg		Tan Biue-green Yellow-green Lt yellow-green	Sample volume, rnl Air rate, liter/hr Condensate return	•		

TABLE 49. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-6 AT 385°F

Sample Data

	is	Neut. No.,	Overhead	Oil Loss,	Acidity,	Overhead Sample Acidity, Vis,
încrease,	, % cs/210°F	mg KOH/g	Wt, g	wt %	mg KOH/k	cs/100°F
I I	4.70	0.24	;			
12.5		0.86	36.6			
23.0	5.57	0.34	53,5			
62.8		1.18	83, 1			
129	65.6	1.78	93.0	58	2.02	11.01
		T	Test Cell Data	at!		
Weight change, mg/cm ² : A	Al -6.02 Ti -0.02	2 2	Sludge in oil:	200-n	200-mesh filter	None
· «		9		,) Sp. 11 1110	11000
S	teel 0.		Tube deposits:		Below oil level	Lt var
O	Cu -0.10	0			At and above oil level	
ξ.	Mg +0.02	2				
Metal discoloration, deposits,	' د	T	Test Conditions	St		
¥,	Al Lt pink			l		
Ţ	Ti Purple		Sample temperature.		° F 385	
∢,			Sample volume, m			
S	Steel Green		Air rate, liter/hr	iter/hr	130	
O		low	Condensate return	return	°N	
2	Mg Lt yellow	wol				

TABLE 50, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-62-6 AT 385°F

rd	i
***	i
ಿ	i
A	
4)	1
_	
0	į
٤	
ત	
S	1

Vis, 100°F Vis vis, Neut. No., Oil Loss, cs/100°F Increase, % cs/210°F mg KOH/g wt %	17.79 4.70 0.24 19.74 11.0 5.10 0.87 21.36 20.1 5.46 0.88 27.25 53.2 6.77 1.09 28.1 58.0 6.56 5.01 54	Wight change, mg/cm ² : Al 0.0 Sludge in oil: 200-mesh filter None Ti +0.02 Centrifuge Trace Ag 0.0 Tube deposits: Below oil level None Cu -0.12 At and above oil Mg +0.04	Metal discoloration, deposits, pitting, or etching: Ti Lt red-blue Sample temperature, °F 385 Ag Lt yellow Sample volume, ml 200 Steel Blue Air rate, liter/hr Cu Yellow-brown Condensate return Yes
Vis,	17.79 19.74 21.36 27.25 28.1		ration, deposit tching: A A A A St
,	Initial 16 hr 24 hr 40 hr 48 hr	Wught change	Metal discoloration, pitting, or etching:

TABLE 51. RESULTS OF REFLUX OXIDATION-CORR SION TEST ON O-62-6 AT 385°F

		ON O-62-6 AT 385°F	AT 385°F		
Sample Data					
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Oil Loss, wt %
Initial	17.79	1	4.70	0.24	
10 nr 24 hr	19.65 21.26	10.5	5.08 5.43	0.79	
40 hr		50,5	6, 63	1, 13	
48 hr	26,53	49.1	5.91	10,78	54
Metal Specimen Data	ata		Test Cell Data	ata	
Weight cha	Weight change, mg/cm ² : 1	Al 0.0 Ti 0.0 Ag 0.0	Sludge in oil:	n oil: 200-mesh filter Centrifuge	lter Non uge Tra
	6 O Z	Steel +0.02 Cu -0.20 Mg :0.04	Tube deposite:	Below oil le At and abov	evel Lt resoil Lt resoil
Metal discoloration, pitting, or etching:	delos	iits, Al NC	Test Conditions		
		blus Lty Lty eel Pea Yell	Sample Sample Air rate Condens	Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return	385 200 130 Yes

None Trace

Lt var

Lt var

TABLE 52, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-62-6 AT 390°F

Sample Data

							Overhead Sample	Sample
	Vis,	100°F Vis	Vis,	Neut. No.,	Overhead	Oil Loss,	Acidity,	Vis,
	1	ļ	1 017/00	III WOILI	Mr. B	W /0	S/uov Su	CS/ 100 F
Initial		3	4.70	0.24	1 1			
16 Fr	90.02	12.8	5.10	0.89	40.5			
24 hr		23.0	5.51	0.91	59.1			
40 hr		144	7.89	27.9	00			
48 hr	(a)	8 E	(a)	36.2	108.5	99	7.12	10.52
Metal Spe	Metal Specimen Data			Η̈́	Test Cell Data	ď		
Weight	Weight change, mg/cm2:		-0.02	2	Sludge in oil:		200-mash filter	(a)
				2	ł		Centrifuge	(a)
		A8		4)	
		Steel		2	Tube deposits:		Below oil level	Lt var
		Cn		0			At and above oil level	vel Lt var
		Mg	+0.04	4.				
Metal	Metal discoloration, doposits	n, deposits,		T	Test Conditions	ns Su		
pitti	pitting, or etching:		Lt green			ı		
					Sample ten	Sample temperature, °F		2
		Αg	NC		Sample volume, m.	ume, m.	200	c
		Steel	Lt brown	ជ	Air rate, liter/Er	liter/Er	13(0
		ņ	Severe pitting	pitting	Condens ate return	e return	SN	
		Mg	Lt yellow	*				

(a) Sample gelled.

TABLE 53. RESULTS OF NONREFLUX OXIDATION-CORROSION TESTON ON O-62-6 AT 390°F

Sample Data

-3.96 -3.96 +0.02 NC Lt blue Lt yellow Yellow-purple Severe etching Yellow

(a) Sample gelled.

TABLE 54. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-6 AT 400°F

Sample Data

		100 %	7:8	N to N	See the second	ניט 1 ניט	Overhead Sample	Sample
	cs/100°F	Increase, %	cs/210°F	mg KOH/g	_	wt %	mg KOH/g	cs/100°F
Initial	17.79	1	4.70	0.24	;			
16 hr	19.98	12.3	4.80	1.00	47.4			
24 hr	23,55	32.4	5.10	20.5	74.9			
40 hr	(a)	:	(a)	37.9	110.8			
48 hr	i i	i i	1	:	ţ	69	1.94	11.27
Metal Spe	Metal Specimen Data			Tes	Test Cell Data			
Weight	Weight change, mg/cm2:	g/cm ² : Al	0	o.0	Sludge in oil:		200-mesh filter	(a)
)-		9	+0.04	•		Centrifuge	(a)
		Ag	0-	-0.04				
		Stee	_		Tube deposits:		Below oil level	Med var
		ก็	-3	-3.94		At and a	At and above oil level	al Med var
		Mg	0	. 26				
Metal	discoloratic	Metal discoloration, deposits,		Tes	Test Conditions	ا مد		
pitti	pitting, or etching:	ing: Al	Z	NC				
		Ti	Lt brown		Sample temperature,		•F 400	0
		Ag			Sample volume, ml	me, ml	200	0
		Stee	1 Green		Air rate, liter/hr	er/hr	13	0
		Ö	Severe	etching	Condensate return	return	No	0
		Mg	Slight pitting	pitting				

(a) Test terminated at 40 hr, sample gelled.

TABLE 55. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-7 AT 390°F

	, g	100°F Vis	Vis.	Neut. No	Overhead	Oil Loss,	Overhead Sample Acidity, Vis,	Sample Vis,
,	cs/100°F	Increase, %	cs/210°F	mg KOH/g	Wt, 8	wt %	mg KOH/g	C8/100°F
Initial	17.42	1	4.19	0.01	;			
16 hr	20,16	15.7	4.60	0.38	24.5			
24 hr		22.2	4.77	0.51	31.0			
40 hr		32.6	5.01	89.0	43.6			
48 hr	45.44	144	6.98	9.01	49.8	33	7.87	9.02
Metal Spe	Metal Specimen Data			Test C	Test Cell Data			
Weight	Weight change, mg/cm ² :	1g/cm ² : Al	+0.04		Sludge in oil:	200-mesh filter	filter	None
			9			Cent	Centrifuge	None
o		Ag	-0-	-0.08			,	1
		Steel			Tube deposits:		level	None
		ő	o-	20		At and abo	At and above oil level	Lt carbon
		Mg	0-	-0.06				
Metal	discoloration	Metal discoloration, deposits,		Test (Test Conditions			
pitti	pitting, or etching:	ing: Al	Lt yellow	low			•	
	ı	Ti	Brown		Sample temperature,	ature, °F	m i	390
		Ag	Lt yellow		Sample volume, ml	, ml	7	00
		Steel	1 Blue-green		Air rate, liter/hr	/hr		30
		ű		80	Condensate return	turn	Z	o N
		Mg	Lt yellow	low				

TABLE 56. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-13 AT 375°F

Sample Data

	Vis,	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead (Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr 48 hr	16.00 17.39 18.41 22.02 26.62	8.7 15.1 37.6 66.4	4.24 4.59 4.75 5.57 6.58	0.25 0.70 0.82 0.89 1.03	29.9 43.3 69.1 79.0	84	1.64	10.62
Metal Spe	Metal Specimen Data			H	Test Cell Data			
Weight	Weight change, mg/cm ² :			0.00	Sludge in oil:	200-n	200-mesh filter Centrifuge	None None
a		Steel Cu Mg		-0.02 -0.06 +0.10	Tube deposits:		Below oil level At and above oil level	Lt var evel Lt var
Metal pitti	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel		brown	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	iperature, ume, ml iter/hr	*F 375 200 130 No	

TABLE 57 RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-13 AT 385°F

Sample Data

Initial 16 hr 24 hr 40 hr 48 hr	Vis, cs/100°F Initial 16.00 16 hr 17.80 24 hr 19.24 40 hr 25.36 48 hr 38.97	100°F Vis Increase, % 11.2 20.2 58.5 144	Vis, cs/210°F 4.24 4.60 4.94 6.25 9.11	Neut. No., mg KOH/g 0.25 0.76 0.79 1.10 1.54	Overhead C Wt, g 38.2 54.7 83.8 93.0	Oil Loss, wt % 57	Overhead Sample Acidity, Vis, mg KOH/g cs/100° 1.91 10.83	Sample Vis, cs/100°F
ineral ape	cimen Data			Te	Test Cell Data			
Weight	Weight change, mg/cm ² ;	g/cm ² ; Al Ti Ag	0.0		Sludge in oil:	200-1	200-mesh filter Centrifuge	None Trace
		Steel Cu Mg		.	Tube deposits:		Below oil level At and above oil level	Lt var el Lt var
Metal d pittin	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu Mg	NC Lt blue Tan Blue Gold Lt yellow		Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	erature, ne, ml er/hr eturn	*F 385 200 130 No	

TABLE 58. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-13 AT 390°F

Sample Data

Sample Vis, cs/100°F	11.00		None (a)	None el Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100°	. 2,30		200-mesh filter Centrifuge	Below oil level At and above oil level	*F 390 200 130 No
Oil Lose,	63	ta	200-r		erature, ne, ml er/hr eturn
Overhead Wt, g	42.8 62.6 96.1 105.2	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperatus Sample volume, m Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.25 0.82 0.91 1.86		0 02 02	08 16 0	·
Vis, cs/210°F	4, 24 4, 64 5, 02 6, 68 14, 41	•	0.0 -0.02	-0.08 -0.16 0.0	NC Lt blue Lt yellow Blue-green Yellow Lt yellow
100°F Vis Increase, %	12.9 20.0 73.4 327			Steel Cu Mg	Metal discoloration, deposits, Pitting, or etching: A1 Ti Ag Steel
Vis, cs/100°F	16.00 18.03 19.71 27.70 68.25	Metal Specimen Data	Weight change, mg/cm ² ;		etal discoloration, Pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spec	Weight		Metal d Pittin

(a) Insufficient sumple.

TABLE 59. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-13 AT 400°F

Sample Data

Sample Vis, cs/100°F	10,55		(a) (a) Hvy var Med var
Overhead Sample Acidity, Vis, mg KOH/g cs/100	14.56		200-mesh filter Centrifuge Below oil level At and above oil level ture, °F 400 ml 200 nr 130 rn No
Oil Loss, wt%	v		200-mesh filter Centrifuge Below oil level At and above oil rature, F e, ml
Overhoad Wt, g	49.4 76.9 109.9	Test Cell Data	Sludge in oil: 200-1 Tube deposits: Belon At an Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.25 1.02 17.86 25.2	Test	H H
Vis, cs/210°F	4.24 4.63 4.80 (a)		+0.06 +0.67 +0.02 -0.08 -11.5 +0.14 NC Lt blue NC Lt yellow Severe etching Slight pitting
100°F Vis Increase, %	12.2 34.7 		Weight change, mg/cm ² : Al Ti Ag Steel Cu Mg Metal discoloration, deposits, pitting, or etching: Ti Ag Steel Cu Mg
Vis, cs/100°F	16.00 17.95 21.55 (a)	Metal Specimen Data	Weight change, mg/cm ² : Metal discoloration, depo
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight Metal d pittin

(a) Test terminated at 40 hr, sample gelied.

TABLE 60. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O.62-16 AT 375°F

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Sample Data
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Overhead Sample	Vis. 2 cs/100°F	10,33		None Trace	Lt var level Lt var	375 200 130 No
Overhe	Acidity, mg KOH/g	1.69		200-mesh filter Centrifuge	Below oil level At and above oillevel	ë Fr
	Oil Loss, wt %	44	SI			t Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
	Overhead Wt, g	28, 9 40, 6 65, 4 75, 6	Test Cell Jata	Sludge in oil:	Tube deposits:	Test Conditions Sample temperatus Sample volume, m Air rate, liter/hr Condensate return
	Neut. No., mg KCH/g	0. 22 0. 71 0. 80 0. 86 0. 99	Ä			·
	Vis, cs/210°F	4.45 4.74 4.98 5.76 6.59		0.0 +0.04 0.0	0.0 -0.06 +0.18	NC Lt blue NC Blue Lt yellow
	Increase, %	8.3 14.4 35.2 57.2			Steel Cu M _s	Matal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
	Vis, ca/100°F	16.84 18.23 19.26 22.77 26.47	imen Data	Weight change, mg/cm ² ;		fetal discoloration, pitting, or etching:
		Initial 16 hr 24 hr 40 hr	Metal Specimen Data	Weight (Metal di pitting

TABLE 61, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-16 AT 385°F

Sample Data	ata							-
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210° F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Lose,	Acidity, Vis	Vis, cs/100°F
Initial	16,84	į	4 45	0 22	i ;			
16 hr	18,82	11.8	4.85	0.76	38.0			
24 hr	20.31	20,6	5. 18	0.82	53.9			
40 hr	25.69	52.6	6,31	1.10	82.8			
48 hr	28.58	69,7	6.11	13,96	94.8	57	1.37	10.80
Metal Spe	Metal Specimen Data			Te	Test Cell Data	-41		
Weight	Weight change, mg/cm^2 :		0.0		Sludge in oil:		200-mesh filter	None
		 [-]	+0.02				Centrifuge	Trac
		Ag						
		Steel			Tube deposits:		Below oil level	Lt va
		r C	-0.16				At and above oil level	
		Mg	+0.08					
Metal o	discoloratio	Metal discoloration, deposits,		Te	Test Conditions	82		
pittin	pitting, or etching:	ng: Al	NO	į		ı		
		Ti	Lt blue		Sample temperature,	perature,	الما د	85
		Ag		wc	Sample volume, ml	ime, ml		200
		Steel			Air rate, liter/hr	ter/hr	~	130
		ູ້. ວິ	Gold		Condensate return	return	4	No
		Mg	Lt yellow	wc				

Lt var Lt var

None Trace

TABLE 62. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-62-16 AT 385°F

Sarnple Data

	Vis, cs/100°F	100°F Vig Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Oil Lose,
Initial	16.84	9	4, 45	0, 22	
16 hr	18.54	10.1	4.78	08.0	
24 hr	19,83	17.8	5.07	0.81	
40 hr	23.89	41.9	6.01	1 20	
48 hr	35,35	110	6.94	21.9	57
Metal Specimen Data	ata		Test Cell Data	ta I	
Weight cha	Weight change, mg/cm ² :	Al 0.0 Ti 0.0 Ag -0.10	Sludge in oil:	200-r	nesh filter None Centrifuge Trace
		el	Tube deposits:		Below oil level Lt var At and above oil level Lt var
Metal disco	Metal discoloration, deposits.		Test Conditions	ns	
pitting, o	pitting, or etching:	Al Lt blue Ti Blue-green Ag NC Steel Blue-green Cu Moderate pitting Mg Lt yellow		Sample temperature, °F Sample volume, ml Air rate, liter/hr Condengate return	385 200 130 Yes

TABLE 63. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-16 AT 390°F

Sample Vis, cs/100°F	10,63		(a) (a)	Lt var 1 Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	5,95		mesh filter Centrifuge	Below oil level At and above oil level	390 200 130 No
Oil Loss, wt %	99		200-1		erature, F° ne, ml er/hr eturn
Overhead Wt, g	38.5 55.9 95.1 100.2	rest Cell Data	Sludge in oil:	Tube deposits:	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.22 0.80 0.93 29.6 34.3	res			Tea
Vis,	4.45 4.86 5.24 8.32 (a)			+0°05	NC Blue-yellow yellow Yellow-red Severe etching
100°F Vis Increase, %	11.8 21.3 173		y cm ² : Al Ti Ag	Steci Ou Mg	n, deposits. gs: Al Ti Ag Steel Cu Mg
Vis, cs/100'F	16.84 18.83 20.43 45.93 (a)	Metal Specimen Data	Weight change, mg/cm ² :		Metal distoloration, deposita pitting, or etchings: Al Ti Ag St
	Initial 16 hr 24 hr 40 hr 48 Er	Metal Spec	Weight		Metal d piting

(a) Sample gelled.

TABLE 64. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-16 AT 390°F

Sample Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss, Wt, g wt%	Oil Loss, wt %	Acidity, Vis, mg KOH/g cs/100°F	Vis, cs/100°F
Initial	16.84	; ;	4.45	0.22	;			
16 hr	18.81	11.7	4.83	0.93	39.8			
24 hr	20,38	21.0	5.19	06.0	58.3			
40 hr	39.87	137	7.39	28.3	98.5			
48 hr	(2)	i i	(a)	(a)	108.7	99	9.14	10.64
etal Spec	Metal Specimen Data			Ţ.	Test Cell Data	m l		
Weight	Weight change mg/cm ² :	g/cm ² ; Al	+0.02	02	Sludge in oil:		200-mesh filter	(a)
		Ti	o°0	0		U	Centrifuge	(a)
		Ag	·	04			o	•
		Steel		10	Tube depos	Tube deposits: Bolow oil level	oil level	Lt var
		Cn	-1.24	24		At and	At and above oil level	-
		Mg	+0.12	12				
Metal d	liscoloratio	Metal discoloration, deposits,		Te	Test Conditions	38		
pittin	pitting, or etching:		NC			1		
			Lt green		Sample temperature,		·F 390	
		Ag	Lt yellow	k	Sample volume, ml	ume, ml	200	
		Steel	Yellow-red	red	Air rate, liter/hr	iter/hr	130	
		r S	Severe etching	etching	Condensate return	return	No	
		80	7: C110:A					

(a) Insufficient sample.

TABLE 65. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-62-16 AT 400°F

Sample Vis, cs/100°F	10.54		(a) (a)	evel Hvy var re oil level Med var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	19.87		200-mesh filter Centrifuge	Tube deposits: Below oil level At and above oil level	200 500 130 No
Oil Loss,	69	ata		posits: Bel	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	46.8 76.2 111.4	Test Cell Data	Sludge in oil:	Tube de	Sample temp Sample volun Air rate, lite Condensate r
Neut. No., mg KOH/g	0.22 1.02 23.2 40.1		+0.14 5.0 +0.04	+0.06 -4.3 -0.34	NC Lt blue NC Lt blue Severe etching Moderate pitting
Vis, cs/210°F	4.45 4.82 5.25 (a)		+0. .0.	+0.06 -4.3 -0.34	
100°F Vis Increase, %	11.1 48.8		g/cm ² : Al Ti Ag	Steel Cu Mg	n, deposits, ng: Al Ti Ag Steel Cu Mg
Vis,	16.84 18.71 25.05 (a)	Metal Specimen Data	Weight change, mg/cm ² :		Metal discoloration, deposit pitting, or etching: T A A A M
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal d pittin

(a) Test terminated at 40 hr, sample gelled.

TABLE 66. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-1 AT 390°F

Overhead Sample Acidity, Vis, mg KOH/g cs/100°F	10.68		(a) (a)	Lt var level None	390 200 130 No
Overhea Acidity, mg KOH/g	2.71		200-mesh filter Centrifuge	Below oil level Lt va At and above oil level None	*F 390 200 130 No
Oil Loss,	63	rd l	200-0		nperature, ume, ml iter/hr
Overhead Wt, g	39.7 58.3 90.4 102.1	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.23 0.63 0.74 2.00 18.93	Te	+0.04 +0.08 -0.06	+0.12 -0.08 +0.22	en er own
Vis, cs/210°F	4.64 5.15 5.57 6.90 14.64		+0.04 +0.08 +0.08	+0.12 -0.08 +0.22	NC Blue Lt yellow Blue-green Reddish-br Yellow
100°F Vis Increase, %	12.9 24.6 62.3 428		g/cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
Vis,	17.48 19.74 21.78 28.37 92.29	imen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight		Metal d pittin

(a) Insufficient sample.

TABLE 67. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-63-2 AT 390°F

Sample Data

Sample Vis, cs/100°F	10.92		None (a)	None vel Lt var	
Overhead Sample Acidity, Vis, mg KOH/k cs/100°F	2.19		200-mesh filter Centrifuge	Below oil level At and above oil level	°F 390 200 130 No
Overhead Oil Loss, Wt, g wt %	61	e)	200 -n		Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
	38.2 56.0 86.8 97.8	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.22 0.62 0.72 1.26	1			n n
Vis,	4.31 5.05 6.32 6.84		+0.02 +0.02 0.0	0.0 +0.14 +0.16	Lt yellow Brown Lt yellow Reddish-blue Blue-brown Dark grey
100°F Vis Increase, %	11.5 21.5 58.1 94.5			Steel Cu Mg	Metal discoloration, deposits, putting, or etching: Ti Ag Steel Cu
V18, c8/100°F	16, 26 18, 13 19, 75 25, 70 31, 63	Metal Specimen Data	Weight change, mg/cm ² ;		etal discoloration, pitting, or etching
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal d pattin

(a) insufficient sample.

TABLE 68. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-3 AT 390°F

Sample Data

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt%	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	15.24 16.95 18.26 148.0 (a)	11.2 19.8 871	4.09 4.38 4.66 18.04 (a)	0.24 0.76 0.76 25.3 23.7	40.8 59.0 101.3	s	11.37	10.39
Metal Spe	Metal Specimen Data			Tes	Test Cell Data			
Weight	Weight change, mg/cm ² :	g/cm ² : Al T: Ag	+0.04 +0.06 -0.04		Sludge in oil:		200-nıesh filter Centrifuge	(a) (a)
		Steel Cu Mg	. •		Tube deposits:		Below oil level At and above oil level	Med var
Metal	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu Mg	NC Blue Lt yellow Blue-green Severe etching	H	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	erature, ne, ml er/hr	°F 390 200 130 No	•

(a) Sample gelled.

TABLE 69, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-7 AT 390°F

Sample Data

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead O Wt, g	Oil Loss, A wt % mg	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	12.75 14.19 15.13 21.31 (a)	11.3 18.7 67.1	3.37 3.65 3.87 5.16 (a)	0.10 0.79 0.68 1.39 (a)	47.6 68.8 104.0	29	24.	10.67
Metal Spe	Metal Specimen Data			Test	Test Cell Data			
Weigh	Weight change, mg/cm ² :		+0.04 0.0		Sludge in oil:	200-mesh filter Centrifuge	ilte <i>r</i> ifuge	(a) (a)
		Stee Cu Mg	=		Tube deposits:		Below oil level Med ar At and above oil level Med var	Med var Med var
Metal pitti	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching:		Tes	Test Conditions			
		Al Ti Ag Steel Cu Mg	Lt yellow Brown-red Brown-red el Blue-green Brown Brown		Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	ature, °F , ml /hr turn	390 200 130 No	

(a) Insufficient sample.

TABLE 70. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-8 AT 375°F

Sample Vis, cs/100°F	11.24		None Trace	None . Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.62		200-mesh filter Centrifuge	Below oil level At and above cil level Lt var	375 200 130 No
Oil Loss, wt % n	27	41			Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	14.5 20.9 34.1 40.0	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature Sample volume, ml Air rate, liter/hr Condensate return
Neut. No.,	0.15 0.34 0.43 0.54	Ĥ			
Vis, cs/210°F	3.50 3.62 3.69 3.77 3.87		-0.02	0.0	NC Lt brown Lt yellow Blue Red-brown Grey
100°F Vis Increase, %	5.6 7.5 11.5 29.0			Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: A1 Ti Ag Steel Cu
Vis, cs/100°F	13.77 14.54 14.80 15.36 17.76	Metal Specimen Data	Weight change, mg/cm ² ;	•	etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spe	Weight		Metal c

TABLE 71. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-8 AT 385'F

Sample Vis.	13.42		None 0.05ml/25 None Lt var	
rt l	2		None 0.05m None Lt var	800 o
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.71		part	385 200 200 130 No
Oil Loss,	iO M	et!	••	nperature, ume, ml iter/hr return
Overhead Wt, g	21.2 30.4 47.0 54.0	Test Cell Lata	Sludge in oil: Tube deposits	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
feut. No., mg KOH/g	0.15 0.43 0.51 0.59	T	U 4 4 2 0 0	
Vis, cs/210°F	3.50 3.65 3.72 3.86 4.01		+0.02 -0.04 -0.04 -0.04 -0.05 -0.12	NC Tan I.t yellow Blue Severe pitting Grey
100°F Vis Increase, %	 9.9 16.1 19.8		s,'cm2: Al Ti Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis,	13,77 14,79 15,14 16,49	Metal Specimen Data	Weight charge, mg/cm2:	stal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spec	Weight	Metal d pittin

TABLE 72. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-63-8 AT 390°F

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Acidity, mg KOH/g	Overhead Sample Acidity, Vis.
Initial	13.77	Ę	3, 50	0 7:				
16 hr	14.80	7.5	3.67	0.45	23.3			
24 hr	15.13	6.6	3.78	0.55	1 m			
40 hr	16.16	17.4	3,92	0,61	73.5			
48 hr	17.09	24.	4.09	0.63	66,2	39	1.88	11.38
Metai Spe	Metal Specimen Data			Test Cell Data	II Data			
Weight	Weight change, mg/cm2:	g/cm ² : Al	0.0		Sludge in oil:	200-mesh filter	ilter	None
		T_i	+0.04			Centrifuge	fuge	0.25 ml/25
		Ag	+0.02)	
		Steel	-0.12		Tube deposits:	Below oil level		None
		ວິ	-0.43			At and above oil level	il level	Lt var
		Mg	-0.26					
Metal d	liscoloration	Metal discoloration, deposits,		Test Co	Test Conditions			
pittin	pitting, or etching:	ng: Al	Lt yellow					
			Brown		Sample temperature,	ture, °F	390	
		Ag	Lt yellow		Sample volume, ml	ml	200	
		Steel	Blue	Air	Air rate, liter/hr	ır	130	
		Ö	Mod etching		Condensate return	rn	°Z	
		Mg	Brown					

TABLE 73. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-8 AT 400 F

TABLE 74. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON C-63-8 AT 400°F

	Vis	10000	- 11			1	Overhead Sample	Sample
	cs/100°F	Increase, %	v1s, cs/210°F	mg KOH/g	Overhead (Wt, g	Oil Loss, wt%	Acidity, mg KOH/g	Vis, cs/100°F
Initial	13.77	!	3,50	0.15	ì			
16 hr	14.92	8.4	3.70	0.58	30.8			
24 hr	15, 39	11.8	3.83	0.67	44.1			
40 hr	17.16	24.6	4.08	0.84	68.7			
48 hr	19.02	38.1	4.45	0.94	78.4	48	2.03	11.45
Metal Spec	Metal Specimen Jata			Η̈́	Test Cell Data			
Weight	Weight change, mg/cm ² :				Sludge in oil:		200 -mesh filter	None
		T_1	,				Centriage	Trace
		Ag)	
		Steel			Tube deposits:		Below oil level	None
		n O				At and	At and above oil level	
		$M_{\mathbf{g}}$	-0.08					
Metal d	liscoloratio	Metal discoloration, deposits,		Te	Test Conditions	v2		
pittin	pitting, or etching:		Lt yellow			ı		
		Ti	Purple		Sample temperature,	perature,	°F 400	
		Ag	NC		Sample volume, ml	me, ml		
		Steel	Lt blue		Air rate, liter/hr	ter/hr	130	
		Qu	Slight pitting	ting	Condensate return	return	N _o	
		Mg	Lt green)				

TABLE 75. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-12 AT 390°F

Sample Data

Sample Vis, cs/100°F	11.64		None (a)	Lt var None	
ਰ			ы в В е н	Below oil level At and above oil level	390 200 130 No
4 E	1.63		200-mesh filter Centrifuge	Below oil level At and above oi	ە تە
Oil Loss,	48				rerature, ne, ml er/hr return
Overhead (Wt, g	29.7 43.8 70.8 82.0	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.23 0.47 0.63 0.68 0.91	Te	4	828	
Vis, cs/210°F	3.91 4.16 4.32 4.93 5.79		40.04 0.0	0.0	Lt blue Blue NC Peacock Mod pitting Orange
100°F Vis Increase, %	9.0 13.7 33.1 61.6		g/cm ² : Al Fi Aø	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
Vis, cs/100°F	15.51 16.90 17.64 20.65 25.06	Metal Specimen Data	Weight clange, mg/cm2:		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal c pittír

(a) Insufficient sample.

TABLE 76. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-13 AT 390°F

	Vis.	100°F Vis	Vis,	Neut. No.,	Overhead Oil Loss,	Oil Loss,	Overhead Sample Acidity, Vis,	Sample Vis,
	C8/100°F	Increase, %	CB/210°F	mg KOH/g	Wt, 8	wt %	mg KOH/g	C8/100°F
Initial	16.88	;	4.39	0.05	;			
16 hr	18.37	8.8	4.72	1.02	25.6			
24 hr	18.78	11.3	4.81	1.17	36.9			
40 hr	19.97	18.3	5.07	1.49	57.8			
48 hr	21.29	26.1	5.37	1.65	67.2	41	3.08	12.12
Metal Spec	Metal Specimen Data			Te	Test Cell Data			
Weight	Weight change, mg/cm ² :	g/cm ² : Al	•	90	Sludge in oil:	200-	200-mesh filter	None
		1		0		O	Centrifuge	Trace
		Ag		0				
		Steel	+0.04	04	Tube deposits:		Below oil level	Lt var
		ົ້ວ		08		At and	At and above oil level	el None
		Mg	-0.08	08				
Metal d	Metal discoloration, deposits	n, deposits,		Te	Test Conditions	20		
pittin	pitting, or etching:		Lt yellow			1		
		Ti	Yellow-blue	blue	Sample temperature,		·F 390	
		A.8	Lt yellow	₩	Sample volume, ml	ıme, ml	200	
		Steel	Brown-yellow	yellow	Air rate, liter/hr	ter/hr	130	
		Ö.	Brown		Condensate return	return	°N	
		S N	Lt yellow	*				

TABLE 77. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-16 AT 385°F

Data
Sample

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss, Wt, g wt %	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100°F	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	16.47 19.01 21.30 30.09 44.47	15.4 29.3 82.7	4.34 4.92 5.36 7.26 10.24	0.29 0.65 0.65 1.14	37.7 54.3 81.6 89.1	56	1.75	9.90
Metal Spe	Metal Specimen Data			Te	Test Cell Data			
Weight	Weight change, mg/cm ² :		+0.02 0.0	N	Sludge in oil:	200-1	200-mesh filter Centrifuge	None Trace
		Steel Steel Cu Mg	-0.02	8 2 2	Tube deposits:		Below oil level At and above oil level	Lt var el Lt var
Metal	discoloratio	Metal discoloration, deposits,		μĬ	Test Conditions	ω J		
pitti	pitting, or etching:	ing: Al Ti Ag Steel Cu	NC Blue NC 1 Yellow Lt brown NC	w	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	perature, ime, ml ter/hr return	*F 385 200 130 No	

At and above oil level Lt var 200-mesh filter Centrifuge Below oil level RESULTS OF REFLUX OXIDATION-CORROSION TEST Sample temperature, Neut. No., mg KOH/g Sample volume, ml 0.84 0.29 0.62 0.67 1,17 Condensate return Air rate, liter/hr Tube deposits: Sludge in oil: Test Conditions Test Cell Data cs/210°F ON O-63-16 AT 385°F 4.80 4,34 5,24 6.98 9.67 Blue-green Blue-red Increase, % -0.02 +0,02 0.0 100°F Vis +0.02 S 25.9 75.1 13.2 Steel Steel Meta discoloration, deposits, ညီ ű Mg Ag Ag Ţ. 4 Weight change, mg/cm2; TABLE 78. cs/100°F Vis, 16.47 18.65 28.84 41.65 20,73 pitting, or etching: Metal Specimen Data 16 hr Initial. 24 hr 40 F 48 F Sample Data

Trace

Yes 200 130

Lt brown

None

58

Oil Loss,

wt %

TABLE 79. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-16 AT 390°F

Sample Dita

	Vis	·#	Vis,	Neut. No.,	Overhead	Oil Loss,	Overhead Sample Acidity, Vis.	Sample Vis,
	cs/100"F	Increase, %	4.017/so	mg KOH/g	Wt, g	WE //0	mg AOH/g	CS/IOU'F
Initial	. 16.47	!	4.34	0.29	!			
16 hr	19.15	16.3	4.99	0. 70	40.9			
24 hr	21, 83	32.5	5.55	0.93	60.3			
40 hr	32.81	99.2	7.60	1.67	7.06			
48 hr	69. 18	320	13, 50	6.73	98.4	29	2, 58	9, 83
Metal Sp	Metal Spigimen Data			H	Test Cell Data	Įa Į		
Weigh	Weigh change, mg/cm ² :		+0.04	4.	Sludge in oil:		200-mesh filter	None
		Ti	+0.02	20			Centrifuge	(a)
		Ag		9(
		Steel		0	Tube deposits:		Below oil level	
	-	Ca	0.0			At an	At and above oil level	vel Lt var
		Mg	-0.02	75				
Metal	discoloration	Metal discoloration, deposits,		C.I	Test Conditions	ons		
pitti	pitting, or etching:	ing: Al	NC	•				
ı	1	Ti	Yellow-blue	-blue	Sample te	Sample temperature,	• F 390	0
		Ag	Lt pink		Sample v	Sample volume, ml	20(0
		Steel		ellow	Air rate, liter/hr	liter/hr	13(0
		Cu	Lt brown	u »	Condensate return	te return	S N	
		Mg	Lt brown	80				

(a) Insufficient sample.

TABLE 80. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-63-16 AT 400°F

Sample Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss wt%	Acidity, mg KOH/g	Vis, cs/100°F
Initial	16.47	:	4.34	0.29	;			
16 hr	19.45	18.1	4.94	0.89	47.9			
24 hr	21.61	31.2	5.31	1.48	70.4			
40 hr	(a)	1	(a)	30.3	111.1			
48 hr	1 1	1 1	:	i I	1	72	11, 63	9.78
Metal Spe	Metal Specimen Data			Ĥ	Test Cell Data	кl		
Weight	Weight change, mg/cm ² :		0.0		Sludge in oil:		200-mesh filter	(a)
	ı	Ti		(9)			Centrifuge	(a)
		Ag		ο)				
		Steel		. 0	Tube deposits:		Below oil level	Lt var
		Ca	-	ælr		At a	At and above oil level	level Lt var
		Mg	-0.4	10				
Metal (discoloratio	Metal discoloration, deposits,			Test Conditions	ns		
pitti	pitting, or etching:	ing: A1	S					
			Yellow		Sample temperature,	nperature	• দ্ৰ	400
		Ag			Sample volume, ml	lume, ml		200
		Steel	Red-green	een	Air rate, liter/hr	liter/hr		130
		Cu			Condensate return	e return		No
		Mg	Lt carbon	noc				

⁽a) Test rerminated at 40 hr, sample gelled.

⁽b) Weight error suspected.

TABLE 81. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-2 AT 375°F

Sample Data

Sample Vis, cs/100°F	(a)		None None	None 1 None	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	2.54		200-mesh filter Centrifuge	Below oil level At and above oil level	• F 375 200 130 No
-	10	ल्	200-1		Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Oil Loss,	3.4	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temperature Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.07 0.09 0.19 0.30	Η̈́			•
Vis, cs/210°F	5.08 5.26 5.38 5.50		-0.02 -0.06 -0.04	+0.02	NC NC Lt yellow Blue Rose NC
100°F Vis Increase, %	6.5 9.2 12.8 14.8		g/cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	27.50 29.29 30.0 4 31.01	Metal Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal of pittir

(a) Insufficient sample.

TABLE 82. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON C-64-2 AT 385*F

Sample Data

Sample Vis, cs/100°E	21.54		None None	None 1 None	
2.9	23		H 0	l oil leve	385 200 130 No
Overheas Sample Acidity, Vis, mg KOH/g cs/100	3.33		200-mesh filter Centrifuge	Below oil level At and above oil level	• [74
Oil Loss, wt %	15	Jata		Tube deposits: Below oil level At and above oi	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	4. 5 6. 1 8. 9 10. 1	Test Cell Data	Sludge in oil:	Tube de	Test Conditions Sample temp Sample volun Air rate, lite Condensate r
Neut. No., mg KOH/g	0.07 0.19 0.25 0.33			,	
Vis, cs/210°F	5. 08 5. 35 5. 45 5. 61 5. 72		-0.06 0.0 +0.06	40.04 -0.10 +0.02	NC Tan Lt yellow Blue Purple
Increase, %	7.4 11.4 14.5			Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu Mg
Vis, cs/100°F	27. 50 29. 54 30. 64 31. 48 32. 65	imen Data	Weight change, mg/cm ² ;		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight	*	Metal d

TABLE 83. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-64-2 AT 385°F

	Vis cs/100°F	100 Incr	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Oil Loss,	
Initial	27.50		: 1	5.08	0.07		
16 hr	29.62		8.8	5,36	0,21		
24 hr	30,72	-	1,7	5,45	0.24		
40 hr	31.85	~	15.8	5,68	0,30		
48 hr	32,59	_	18.5	5, 70	0,31	16	
Metal Specimen Data	Data			. Test Cell Data	Data		
Weight ch	Weight change, mg/cm2:	A1	-0.04	Sludge	Sludge in oil: 200-me	200-mesh filter	None
		ij	o.c	•	Cel	Centrifuge	None
		Ag	+0.02			ì	
		Steel	-0.04	Tube d	Tube deposits: Below oil level	il level	None
		Č	-0.06			At and above oil level	
.		Mg	0.0				
Metal dis	Metal discoloration, depos	sits,		Test Conditions	itions		
pitting,	pitting, or etching:	Ąį	NC				
		Z	Lt tan	Sampl	Sample temperature, *F	385	
			Lt yellow	Sample	Sample volume, ml	200	
		[a]	Blue	Air ra	Air rate, liter/hr	130	
		ຶ່ ບຶ ້	Purple NC	Conde	Condensate return	Yes	
		10	2				

TABLE 84. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-2 AT 390°F

			•				Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis,
Initial	.7.50	;	5, 08	0.07	\$ \$			
16 hr	30, 25	10.0	5, 39	0.33	6.0			
24 hr	31, 13	13.2	5, 49	0.27	8.6			
40 hr	32.59	18, 5	5.69	0.36	12.9			
48 hr	33.50	21.8	5.81	0,36	14.5	17	5.69	21.34
Metal Spe	Metal Specimen Data				Test Cell Data	ıta		
Weight	Weight change, mg/cm ² :	g/cm ² : Al	+0.06		Sludge in oil:		200-mesh filter	None
)		Ti	+0,04				Centrifuge	None
		Ag	-0.04					
		Steei	-0.05		Tube deposits:		Below oil level	None
		Cn	-0.08			At a	At and above oil level	level None
		Mg	90.0-					
Metal	discoloratic	Metal discoloration, deposits,			Test Conditions	suoi		
pitti	pitting, or etching:	ing: Al	S	•]		
1)	Ti	Grey		Sample to	Sample temperature,	• দ্ৰ	0
		Ag	Yellow		Sample v	Sample volume, ml	200	0
		Steel	Blue		Air rate,	Air rate, liter/hr	13	0
		Cn			Condensa	Condensate return	No	•
		Mg	NC					

TABLE 85. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-2 AT 400°F

Sample Vis,	21.32		None None	None	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	3.93		200-mesh filter Centrifuge	Below oil level At and above oil level None	*F 400 200 130 No
Oil Loss,	20	lata			Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	10. 4 14. 7 21. 4 23. 9	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temp Sample volun Air rate, lite Condensate r
Neut. No., mg KOH/g	0. 07 0. 30 0. 40 0. 43	• 1	#1.0	0	
Vis, cs/210°F	5. 08 5. 48 5. 58 5. 81 6. 01		+0. ?4 - 9. 06 0. 0	+0.30 -1.54 0.0	NC NC NC Lt blue Mod pitting Rose
100°F Vis Increase, 9	12.3 16.2 22.9 27.8		/cm ² : Al Ti Ag	Steel Cu Mg	i, deposits, ig: Al Ti Ag Steel Cu
Vis, cs/100°F	27, 50 30, 89 31, 96 35, 81 35, 15	Metal Specimen Data	Weight charge, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Al Ti Ag Ag Stee
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spe	Weight		Metal d pittin

TABLE 86. RESULTS OF NONREFLUX OXIDATION-CGRROSION TEST CN C-64-12 AT 375°F

Sample Data

Sample Vis, cs/100°F	11. 61		None 0.20ml/25	Lt carbon Lt carbon	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	2. 48		filter ifuge	Below oil level At and above oil level	375 200 130 No
Oil Loss, wt %	23		290-mesh filter Centrifuge	·	ature, •F , ml hr urn
Overhead Wt, g	10.9 15.8 25.3 29.4	Test Cell Data	:lio ui egpnlS	Tube deposits:	Test Conditions Sample 'emperature, Sample volume, ml Air rate, 'iter/hr Condensate return
Neut. No.	0, 25 0, 61 0, 75 0, 89 0, 96	Test C			T e
Vis, cs/210°F	3, 52 3, 77 3, 88 3, 91 3, 85		÷0.12 +0.08 +0.12	+0.16 -0.10 +0.20	Lt brown Dk brown Lt brown Brown Brown
100°F Vis	12. 0 13. 0 14. 8			Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
Vis, cs/100°F	13.79 15.44 15.58 15.83	Metal Specimen Data	Weight change, mg/cm ² :		pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spe	Weight		Metal d pittin

TABLE 87. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-64-12 AT 385*F

Sample Data

Overhead Sample Acidity, Vis, g KOH/g cs/100°F	11.95	None 0.40 ml/25 Lt carbon Lt carbon	
Overhead Acidity, mg KOH/g	2.85	200-mesh filter None Centrifuge 0.40 ml/2 Below oil level Lt carbon At and above oil level Lt carbon	385 200 130 No
Oil Loss, wt %	31	200-mesh filter Centrifuge Below oil level At and above oil	iture, °F ml hr irn
Overhead Wt, g	25 88 16.0 86 22.9 11 35.5 27 41.0 Test Cell Data	Sludge in oil: Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Naut. No., mg KOH/g	0.25 0.88 0.86 1.11 1.27 Test Co	Slud Tubo	Te
Vis, l	3. 52 3. 70 3. 98 4. 04 3. 86	+0.26 +0.36 +0.24 +0.28 -0.16	Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon Aottled carbon Lt carbon
100°F Vis Increase, %	6.7 11.6 15.7 14.4	//cm ² : Al Ti Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu Mg
Vis, cs/100°F	Initial 13.79 16 hr 14.71 24 hr 15.39 40 hr 15.95 48 hr 15.78 Metal Specimen Data	Weig't change, mg/cm ² :	etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr Metal Spec	Weig't	Metal d pittin

TABLE 88. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-12 AT 390°F

	Vis,	100°F Vis	Vis,	Neut. No.,	Overhead	$\mathbf{\mathcal{I}}$	Overhead Sample Acidity, Vis,	I
	7 001	Milledse, 70	C8/210 F	al non gu	Wt, g	Wt %	mg KOH/g	cs/100.5
***	3.79	ŧ	3.52	0.25	!			
~	5, 55	12.8	3,90	0.90	20.6			
_	5.81	14.6	3,85	1.04	30.0			
	5.78	14.4	3.89	0.93	47.5			
-	5.96	15.7	3.91	1,36	55.6	34	3.16	12.14
Ë	Metal Specimen Data			Test C	Test Cell Data			
chi	Weight change, mg/cm ² :				Sludge in oil:	200-mesh filter Centrifuge		None 0.75 m1/25
		Steel			e deposits:	Tube deposits: Below oil level		Lt carbon
		Cu				At and abov	At and above oil level]	Lt carbon
		Mg	+0.24					
ः •	oloratio	Metal discoloration, deposits,		Test C	Test Conditions			
56	pitting, or etching:	ng: Al	Lt carbon					
		T_i	Lt carbon		Sample temperature,	ature, °F	3	06
		Ag	Lt carbon		Sample volume, m	. ii.	2	200
		St. e!			Air rate, liter/hr	/hr	T	130
		ς Σ	Sight pitting Lt carbon		Condensate return	urn	4	°N.
)		!				

TABLE 99. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-12 AT 400°F

Sample Vis,	cs/100°F					12.22		None	0.25 ml/25		Lt carbon	Lt carbon									
Overhead Sample Acidity, Vis,	mg KOH/g					3.86						l level				400	200	130	8 2)	
Oil Loss,	wt %					43		200-mesh filter	Centrifuge		Tube deposits: Below oil level	At and above oil level				ature, °F	. m	1. 4.	14.	:	
Overhead	Wt, g	i i	25.1	35.9	55, 6	64.3	Test Cell Data	Sludge in oil:	,		e deposits:			Test Conditions		Sample temperature,	Sample volume, ml	Air rate liter/hr	Condensate return		
Neut. No.,	mg KOH/g	0.25	1.17	1.44	1.86	2.24	Test C	Slud			Tub			Test C							
Vis,	cs/210°F	3.52	3.81	3.90	4.01	≥		+0.51	+0.51	+0.37	+0.24	+0.12	+0.40		Lt carbon	Lt carbon	Lt carbon				
100°F Vis	Increase, %	;	7.30	15.4	20.7	23.4			Ti	Ag	Steel	Cu	Mg	n, deposits,		Ti	Ag	Steel	່ ເວ	Mg	i
Vis,	CB/100°F	13.79	15.56	15.91	16.64	17.02	Metal Specimen Data	Weight change, mg/cm2;						Metal discoloration, deposit	pitting, or etching:						
		Initial	16 hr	24 hr	40 hr	48 hr	Metal Spec	Weight						Metal	pittir						

TABLE 90. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-64-13 AT 375°F

0.05ml/25 cs/100°F Vis, Overhead Sample (a) None None At and above oil level None mg KOH/g Acidity, 1.35 200-mesh filter Centrifuge Tube deposits: Below oil level Oil Loss, wt w Sludge in oil: Overhead Wt, g Test Cell Data 4.6 5.1 Neut. No. mg KOH/g 90.0 0.28 0.05 0.07 +0.04 -0.02 -0.02 -0.47 +0.04 cs/210°F 5.32 5.00 5.88 5.68 Vis, Steel Ç Increase, % Ag 100°F Vis 14.6 9.2 6.9 Weight change, mg/cm2: Metal Specimen Data cs/100°F 31.05 32.57 30,38 33,37 28.43 Sample Data 24 hr 40 hr 48 hr 16 hr Initial

(a) Insufficient sample.

375

e T

> Sample temperature, Sample volume, ml

Test Conditions

N N N

Metal discoloration, deposits,

pitting, or etching:

0.0

Mg

Air rate, liter/hr Condensate return

Slight etching

Lt brown

Steel

Ag

A Ti సే

White

200 130 No

TABLE 91. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-13 AT 385°F

								į
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Acidity, mg KOH/g	Overhead Sample Acidity, Vis, g KOH/g cs/100°F
Initial 16 hr	28.43 30.83	• & • • 4	5.32	0.28	5.8			
24 hr 40 hr	31.76	11.7	5.76	0.05	8.1			
48 hr	35.32	24.2	6.24	0.10	12.7	19	1.57	17.74
Metal Spe	Metal Specimen Data			Test Cell Data	II Data			
Weight	Weight change, mg/cm ² :		0.0		Sludge in oil:	200-mesh filter Centrifuge	ilter fuge	None 0.05m1/25
		Ag	+0.04		, .		, 0	
		Steel Cu	-0.02		deposi::	Tube deposi∷: Below oil level At and above oil level None	evel	None
		Mg	0.0					
Metal disc	Metal discoloration, deposits,	deposits,		Test Co	Test Conditions			
pittir	pitting, or etching:	ing: Al	NC					
			Tan	Sam	Sample temperature,	ture, 'F	385	
		Ag	•		Sample volume, ml	ml	200	
		Steel			Air rate, liter/hr	hr	130	
		លី 🕱	Slight pitting NC		Condensate return	ırn	°Z	
		•						

TABLE 92. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-64-13 AT 385°F

Oil Loss, wt %	9	5	nesh filter None Centrifuge 0.05 ml/25	evel None ve ojl level None		385 200 130 Yes
Neut. No., mg KOH/g	0.28 0.02 0.03 0.04		200-n	Below oil I At and abo	ions	Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F	5.32 5.65 5.76 6.03	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions	
100°F Vis Increase, %	8.2 11.0 17.9 22.6		+0.04 0.0	7 7	NC	Lt tan White Yellow-brown Lt pitting NC
HI			.2: Al Ti Ag	Steel Cu Mg	posits, Al	Ti Ag Steel Cu Mg
Vis, cs/100°F	28.43 30.77 31.56 33.53 34.85	ata	Weight change, mg/cm ² ;		Metal discoloration, deposits, pitting, or etching: Al	
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight ch	r	Metal disc pitting, c	

TABLE 93. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-64-13 AT 390°F

Sample Data

Overhead Sample Acidity, Vis, mg KOH/g cs/100°F	1.74 17.55		lter None fuge 0.05m1/25 vel None e oil level None	390 200 130 No
Oil Loss, wt %	57		Sludge in oil: 200-mesh filter Centrifuge Tube deposits: Below oil level At and above oil level	ature, °F s, ml /hr turn
Overhead Wt, g	9.7 13.9 20.8 23.4	Test Cell Data	Sludge in oil: Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.28 0.04 0.10 0.63	Test C		Tea
Vis, cs/216°F	5.32 5.64 5.81 6.11		-0.02 -0.02 0.0 -0.10 -0.67	NC Lt yellow NC Lt brown Severe etching
100°F Vis Increase, %	8.6 12.1 20.3 26.2		g/cm ² : Al Ti Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	28.43 30.88 31.86 34.21 35.87	Metal Specimen Data	Weight change, mg/cm ² :	stal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spe	Weight	Metal pittii

TABLE 94. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-13 AT 400°F

Sample Data

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Overhead Wt. g	Oil Loss, wt %	Overhead Acidity, mg KOH/g	Overhead Sample Acidity, Vis, g KOH/g cs/100°F
Initial 16 hr 24 hr 40 hr	28.43 31.67 33.21	11.4	5.32 5.76 5.96 6.44	0.28 0.06 0.09	13.0 18.3 26.0			
48 hr	80.52	183	10.48	5.73	34.4	30	27.22	14.88
Metal Spe	Metal Specimen Data			Test (Test Cell Data			
Weight	Weight change, mg/cm ² :		+0.14 -0.18 0.0		Sludge in oil:	200-mesh filter Centrifuge	nesh filter Centrifuge	None 0.10 m1/25
	er.	Steel Cu Mg	н		Tube deposits:	Below oil level At and above oi	Below oil level None At and above oil level None	None None
Metal pitti	etal discoloration, opitting, or etching;	Metal discoloration, deposits, pitting, or etching:	U Z		Test Conditions			
•			NC White		Sample temperature, Sample volume, ml	ature, °F, ml	4.2	400 200
		Steel Cu Mg	l Purple Severe etching NC		Air rate, liter/hr Condensate return	/hr urn	- 4	130 No

TABLE 95. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-16 AT 385°F

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead (Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	13.06 13.56 13.43 13.77	3.8 8.2 4.7	3.34 3.42 3.44 44 55	0.17 1.02 1.21 1.48 1.57	15.8 23.1 37.6 44.8	87	4.08	12.58
Metal Spe	Metal Specimen Data			Test	Test Cell Data			
Weight	Weight change, mg/cm ² :	g/cm ² : Al Ti Ag	+0.14 +0.14	ώ	Sludge in oil:	200-mesh filter Centrifuge	nesh filter Gentrifuge	None Trace
		Steel Cu Mg	999	H	Tube deposits:		Below oil level At and above oil level	Med var
Metal	discoloration	depos	4		Test Conditions			
	Premise of econing:	nig: Ai Ti Ag Steel Cu Mg	Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon Lt carbon		Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	rature, °F e, ml r/hr :turn	385 200 130 No	νοο."

TABLE 96. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-16 AT 390°F

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No.,	Overhead Wt, g	Oil Loss, wt%	Acidity, mg KOH/g	Vis, cs/100°F
Initial	13.06	1	3,34	0.17	1			
16 hr	13.63	4.	3.44	1.14	18.0			
24 hr	13.59	4.1	3, 43	1.35	27.0			
40 hr	13.76	5.4	3.46	1.97	44.5			
48 hr	17.09	30.9	3.96	13.97	55.6	36	5,72	12.26
Metal Spe	Metal Specimen Data			Test	Test Cell Data			
Weight	Weight change, mg/cm2:		+0.26	S1	Sludge in oil:	200-rnesh filter	h filter	None
))	Ti	+0.22		ı	Cen	Centrifuge	None
		Ag	+0.30					
		Steel	10.20	Ţ	Tube deposits:	: Below oil level	l level	Med var
		n O					At and above oil level Med var	Med var
		Mg	+0.28					
Metal	Metal discoloration, deposit	on, deposits,		Test	Test Conditions			
pitti	pitting, or etching:		Lt carbon	ű				
•	ı	Ti			Sample temperature,	rature, °F		
		Ag	Lt carbon		Sample volume, ml	ie, ml	200	
		Steel	Lt carbon		Air rate, liter/hr	r/hr	130	
		Ω O	Lt carbon		Condensate return	eturn	No	
		Mg	Lt carbon	u,				

TABLE 97. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-16 AT 390°F

	V.s.	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss,	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial	13.06	:	3,34	0.17	;			
16 hr	13,54	3.7	3,43	1.09	17.9			
24 hr	13.64	4.4	3.42	1.16	26.9			
40 hr	13.80	5.7	3.47	1.80	45.1			
48 hr	16.39	25.5	3.86	11.40	55,3	37	5.03	12.30
Metal Spe	Metal Specimen Data			Tes	Test Cell Data			
Weight	Weight change, mg/cm ² :	g/cm ² : Al	+0.28		Sludge in oil:	200-n	sh filter	None
		Ti	+0,32	2		ပီ	Centrifuge	Trace
		Α. 98	+0.24	4				
		Steel	+0.22		Tube deposits:	s: Below oil level	il level	Lt var
		ű	+0.16	9		At and a	At and above oil level	l Lt var
		Mg	+0.20	0				
Meal	Me al discoloration, deposit	on, deposits,		Tes	Test Conditions			
pitti	pitting, or etching:		Lt carbon					
	ı		Lt carbon		Sample temperature,	erature, °F	390	
		Ag	Lt carbon		Sample volume, ml	ne, ml	200	
		Steel	Lt carbon		Air rate, liter/hr	r/hr	130	
		Cu	Mettled carbon		Condensate return	eturn	oN.	
		Mg	Lt carbon	c				

TABLE 98, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-16 AT 400°F

Sampie Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss,	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
Initial	13.06	i i	3.34	0.17	ŧ ;			
16 hr	13.51	4.2	3.42	1.41	24.4			
24 hr		4.4	3.43	1.78	36.0			
40 hr	191.5	1365	6.85	43.6	76.8			
48 hr		1	(a)	49.6	84.7	55	24.7	11.33
Metal Spe	Metal Specimen Data			Te	Test Cell Data	-1		
Weight	change, m	Weight change, mg/cm ² : Al	+0.41		Sludge in oil:		200-mesh filter	(a)
))	Ţ	+0.30)		Centrifuge	(a)
		Ag	+0.53					
		Steel			Tube deposits:	its: Below	Below oil level	Lt var
		Cu	+0.14			At and	At and above oil level	vel Lt var
		Mg	+0.16					
Metal	Metal discoloration, deposits	on, deposits,		Te	Test Conditions	S		
pitti	pitting, or etching:	ing: Al	Lt carbon	E E		l		
)	Ti	Lt carbon	ជ	Sample temperature,	perature,	•F 400	0
		A.8	Lt carbon	Ľ	Sample volume, ml	ume, ml	200	0
		Steel		E	Air rate, liter/hr	iter/h-	13	0
		Cn	Lt carbon	u	Condensate return	return	°N	
		Mg	Lt carbon	Ę				

(a) Sample gelled.

TABLE 99. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-18 AT 375°F

							Oresthos	Overhood Same
	Vis, cs/100'F	100°F Vis Increase, %	Vis, cs/210°F	Veut. No., ng KOH/g	Overhead Wt, g	Oil Loss. wt %	Acidity, mg KOH/g	Vis, cs/100'F
Initial	16.84	;	4, 20		!			
16 hr	18.00	6.9	4.53	0.66	13.6			
hr	18.46	9.6	4.61	02.0	19.0			
40 hr	19.52	15.9	4,84	0.93	30.4			
48 hr	20.27	20.4	5.00	1.10	34.7	28	2.56	11.02
Spe	Metal Specimer Data			Test C	Test Cell Data			
ght	Weight change, mg/cm ² ;	g/cm ² : Al Ti Ag	0.0 +0.04 -0.02	Slud	Sludge in oil:	200-mesh filter Centrifuge	filte r ifuge	None Trace
		Steel Cu Mg	+0.04	Tube	Tube deposits:	Below oil level At and above oi	Below oil level At and above oil level	Lt var Lt carbon
al d	iscoloration	Metal discoloration, deposits,		Test Co	Test Conditions			
ttin	pitting, or etching:		Grey Lt yellow Lt yellow Brown Lt green	Sam Sam Air Conc	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	iture, °F ml hr irn	375 200 130 No	
		M ₈	O Z					

TABLE 100. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-18 AT 385°F

Sample Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Loss, Wt, g wt%	Oil Loss, wt%	Aciaity, mg KOH/g	Vis, cs/100'F
Initial	16.84	ŧ ŧ	4.29	0.11	;			
16 hr	18.31	8.7	4.56	0.86	22.8			
24 hr		11.6	4.69	96.0	31.7			
40 hr		20.0	4.96	1.45	47.9			
48 hr	21.42	27.2	5.22	1.69	55.0	36	3.11	11,21
Metal Spe	Metal Specimen Data	ا س		Te	Test Cell Data			
Weight	Weight change, mg/cm2;		0.0		Sludge in oil:		200-mesh filter	None
,		Ti	0.0)		Centrifuge	Trace
		A£	0.0					
		Steel	0.0		Tube deposits:		Below oil level	Lt var
		Cc	-0,10		•		At and above oil level	
		Mg	-0.02					
Metal	Metal discoluration, deposit	on, deposits,		Te	Test Conditions	ø		
pitti	pitting, or etching:	ing: Al	Grey			!		
	i	Ti	Blue		Sample temperature,		°F 385	
		Ag	NC		Sample volume, ml	ıme, ml	200	
		Steel	Blue-green		Air rate, liter/hr	ter/hr	130	
		Cr		٦.	Condensate return	return	No	
		Mg	Grey					

TABLE 101. RESULTS OF NONREFLUX OXILATIC N-CORROSION TEST ON O-64-18 AT 390°F

	V18, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Iritial	16.84	;	4.29	0.11	1			
16 hr	18.33	8.8	4.58	0,98	25,7			
24 hr	18.87	12.1	4.68	1.19	36.9			
40 hr	20.36	20.9	5.01	1.91	37.3			
48 hr	22.08	31.1	4.97	3, 19	47.4	43	2.47	10.75
Metal Spe	Metal Specimen Data			Te	Test Celi Data	.1		
Weight	Weight change, rag/cm2;		+0.02		Sludge in oil:		200-mesh filter	None
		Ti	-0.02		ı	U	Centrifuge	Trace
		Ag	70.0+)	
		Steel	-0.02		Tube deposits:		Below oi! level	Lt var
		Cu	-0.26				At and above oil level	
		M	0.0					
Metal	Metal discoloration, deposit	n, deposits,		Te	Test Conditions	Ś		
pittir	pitting, or etching:	ng: Al	Grey	1		1		
	,		Blue		Sample temperature,		°F 390	
		Ag	Lt yellow		Sample volume, ml	ıme, ml	200	
		Steel	Yellow-green	reen	Air rate, liter/hr	ter/hr	130	
		Cu Mg	Slight etching Green	hing	Condensate return	return	No	

TABLE 102, RESULTS OF NONREFLUX ONIDATION-CORROSION TEST ON O-64-18 AT 400°F

Sample Data

Sample Vis, cs/100°F	10.93	(a) (a) Lt var evel Lt var	0.0.0
Overhead Sample Acidity, Vis, mg KOH/g cs/100	15.25	200-mesh filter Centrifuge Below oil level At and above oil level	, °F 400 200 130 No
Oil Loss,	58 ata	••	Sample temperature, Sample volume, ml Ai: rate, liter/hr Condensate return
Overhead Wt, g	33.8 47.6 84.9 93.0 Test Cell Data	Sluage in oil: Tube deposits:	Test Conditions Sample temp Sample volur Ai: rate, litt Condensate i
Neut. No., mg KOH/g	0.11 1.32 1.84 34.8 (a)	2(b) 2 2 5 0 10	Lt yellow Lt yellow Lt yellow Brown Severe etching Lt gree
V1S,	4.29 4.62 4.73 9.32 (a)	0.0 -0.22(b) -0.02 1 +0.02 -1.40 +0.02	_
100°F Vis Increase, %	10.3 14.0 1140	g/cm ² : Al Ti Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Ti Ag Steel
Via, cs/100°F	Initial 16.84 16 hr 18.58 24 hr 19.19 40 hr 208.5 48 hr (a)	Weight change, mg/cm ² :	etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr Metal Spec	Weight	Metal c

⁽a) Insufficient sample.

⁽b) Weight error suspected.

TABLE 103. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-21 AT 390°F

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg XOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr 48 hr	15.56 15.97 16.11 16.46 16.74	. 5 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	3.55 3.62 3.63 3.72	0.07 0.10 0.12 0.22 0.26	13.3 19.5 31.5	26	1.64	15.36
Metal Spe	Metal Specimen Data			HI	Test Cell Data	् ले		
Weight	Weight change, mg/cm ² :		-0.02 0.0	2 0 0	Sludge in oil:		200-mesh filter Centrifuge	None Trace
		Steel Cu Mg		26	Tube deposits:		Below oil level At and above oil level	None evel None
Metal c	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu Mg	NC Lt brown Lt yellow el Blue Slight pitting	·	Sample temperature Sample volume, ml Air rate, liter/hr Condensate return	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	ĵ.	390 200 130 No

TABLE 104. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-54-22 AT 385°F

Sample Vis, cs/100°F	14.97		None None	None level None	
Overhead Sample Acidity, Vis, ing KOH/g cs/100	2.41		200-mesh filter Centrifuge	Below oil level At and above oil level None	e, °F 385 1 200 130 No
Oil Loss, wt %	23	Data		Tube deposite: Bel	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	8.1 13.1 22.7 27.4	Test Cell Data	Sludge in oil:	Tube de	Test Conditions Sample temp Sample volur Air rate, lite Condensate r
Neut. No., mg KOH/g	0.17 0.20 0.28 0.40	Electro-	-0.02	-0.02 -0.10 -0.10	
Vis, cs/210°F	4.09 4.21 4.25 4.34	Normal Clean-up	0.0	-0.02 -0.06 -0.08	NC Lt tan Lt yellow Purple Red-yellow Grey
100°F Vis Increase, %	3.9 5.4 7.8		s/cm ² : Al Ti Aø	Steel Cu Mg	deposits, Al Ti Ag Steel Cu Mg
Vis, cs/100°F	18.28 19.00 19.26 19.70 20.17	Metal Specimen Data	Weight change, mg/cm ² : Al Ti		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal d pittin

TABLE 105. RESULTS OF REFLUX OXIDATION-COPROSION TEST ON O-64-22 AT 385°F

	Vis,	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Oil Loss,	
Initial 16 hr 24 hr 40 hr 48 hr	18.28 19.00 19.27 19.70 20.11	3.9 5.4 7.8 10.0	4.09 4.23 4.36 4.39	0.17 0.20 0.27 0.38	24	
Metal Specimen Data	Jata		Test Cell Data	Jata		
Weight ch	Weight change, mg/cm ² :	Al +0.02 Ti -0.04 Ag -0.06	Sludge in oil:	200-1	mesh filter Centrifuge	None None
• • • • • • • • • • • • • • • • • • • •		~	Tube d	Tube deposits: Below oil level At and above oi	Below oil level At and above oil level	None None
Metal disc pitting,	Metal discoloration, depos pitting, or etching:	sits, Al NC	Test Conditions	tions		
		Ti Lt tan Ag NG Steel Purple Cu Yellow-orange Mg Grey		Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return	385 200 130 Yes	

TABLE 106. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-22 AT 390°F

Sample Data

ımple	Vis, cs/100°F		15.03		None		None	vel None						
Overhead Sample	Acidity, mg KOH/g co		2.16		200-mesh filter Centrifuge		Below oil level	At and above oil level			, Eri	200	130	No
	Oil Loss,		97	ata				At ar		ions	Sample temperature,	Sample volume, ml	Air rate, liter/hr	Condensate return
	Cverhead Oil Loss,	9.7	33.2	Test Cell Data	Sludge in oil:		Tube deposits:			Test Conditions	Sample t	Sample v	Air rate,	Condensa
•	Neut. No., mg KOH/g	0.17 0.22 0.31	0.43	• ,	~	1 4.	4	2	9	·				range
	Vis, cs/210°F	4.09 4.22 4.26	4.36		0.0			-0.05	-0.16	ב ב	Lt tan	NC	Purple	Brown-orange Grey
	100°F Vis Increase, %	4.2	9.1			Ag	Steel	က္ခ	Mg	Metal discoloration, deposits, pitting, or etching:		Ag	Steel	Cu
	Vis, cs/100°F	18.28 19.04 19.38	19.95	Metal Specimen Data	Weight change, mg/cm ² ;					stal discoloration, opitting, or etching:				
		Initial 16 hr 24 hr	40 hr 48 hr	Metal Spec	Weight					Metal c	•			,

TABLE 107. RESULTS OF NONFEFLUX OXIDATION-CORROSION TEST ON O-64-22 AT 390°F

Sample Vis,	15.07		None	None evel None	390 200 330 No
Overhead Sample Acidity, Vis, ing KOH/g cs/100	2.60		200-mesh filter Contrifuge	Below oil level At an tabove oil level	ĕ ₹ ≈ Z
Oil Loss,	5. 4.	ta			Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	11.9 17.5 28.2 33.2	Test Cell Data	Sludge in oil:	Tube deponits:	Test Conditions Sample temperature Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.17 0.24 0.30 0.42 0.47	T			Ţļ
Vis, cs/210°F	4.09 4.22 4.26 4.29		10.06 10.06 0.0	0.04	NC Tan White Purfle Orange Grey
00°F Vis Increase, %	4.2 5.6 8.5 11.2		g/cm ² : Al Ti Ag	St. el Cu Mg	Metal discoloration, deposits, 2:tting, or etching: Al Fi Ag Steel Cu Mg
Vis. cs/100°F	18,28 19,04 19,3; 19,84 20,32	Metal Specimen Data	Weight change, ng/cm^2 :		etal discoloration, distring, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spec	Weight		Metal di

TABLE 108. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-22 AT 400°F

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss,	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	18.28 19.20 19.52 20.35 21.17	5.0 6.8 11.3 15.8	4.09 4.23 4.44 4.52	0.17 0.31 0.40 0.53	10.8 19.3 35.4	32	2.47	15.02
Metal Spe	Metal Specimen Bata			Fi	Test Cell Data	ća I		
Weight	Weight change, mg/cm ² :	g/cm ² : Al Ti Ag	-0.02 -0.02 -0.02		Sludge in oil:		200-mesh filter Certrifuge	None None
		Steel Cu Mg	.0.02		Tube deposits:		Below oil level At and above o∵l	None
Metal c	etal discoloration, pitting, or etching:	depoe	S	<u> </u>	Test Conditions	suc		
		Ti Ag Steel Cu Mg	Lt tan NC Blue Green-orange Slight etching	ange hing	Sample temperature Sample volume, ml Air rate, lite:/hr Condensate return	Sample temperature, Sample volume, ml Air rate, lite:/hr Condensate return	f r:	400 2¢¢ 130 No

TABLE 103. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-25 AT 385°F

Sample Data

Sample Vis, cs/100°F	21.51		None 0.05 m1/25	None Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.89		mesh filter Centrifuge	Below oil level None At and above oil level Lt var	385 200 130 No
Oil Loss,	12		200-mesh filter Centrifuge		ature, °F , ml /hr urn
Cverhead Wt. g	8 3.7 8	Test Cell Data	Sludge in cil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.07 0.09 0.13	Test C	Sluc	Tub	H
Vis,	5.35 5.55 5.60 5.72		+0.06 -0.06 +0.04	+0.06 -0.06 -0.06	NC Can Lt tan Blue-green Brown
100°F Vis Increase, 70	2.4.2 8.9 9.0			Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	28.76 29.98 30.54 31.31	Metal Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight		Metal of pittin

TABLE 110. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-64-25 AT 385°F

		17:0
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Sample Data		
S)		

	Vis, cs/100°F	100 Incr	100°F Vis Increase, %	Vis, cs/210° F	Neut. No.,	Oil Loss,
Initial 16 hg	28,76	' 4	, 4 , 4	5.36	0.0	
24 hr	30.53	r 90	4. <i>3</i> 6.2	# 6\ n	0.14	
40 hr	31,23	80	8.8	5, 68	0.14	
48 hr	31.74	10.4	4.	5.74	0, 15	12
Metal Specimen Data	Jata			Test Cell Data	Jata	
Weight ch	Weight change, mg/cm ² :	A Ti Ag	0°0 -0°0 0°0	Sludge in oil:		200-mesh filter None Centrifuge 0,05 ml/25
		Steel Cu Mg	0.0 -0.16 0.0	Tube d	Tube deposits: Below oil level At and above oil level	Below oil level None At and above oil level None
Metal disc	Metal discoloration, deposits, pitting, or etching:	sits, Al	U	Test Conditions	tions	
)		Lt tan	Sample	Sample temperature, 'F	
		Ag	S	Sample	Sample volume, ml	200
		Steel	Green-blue	Air rat	Air rate, liter/hr	130
		Ç Z 08	Orange NC	Conden	Condensate return	Yes

TABLE 111, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-64-25 AT 385°F

Sample Data

Oil Loss, wt %	11		200-mesh filter Nous Centrifuge 0. C. ml/25	Below oil level None At and above oil level None	385 200 130 Yes
Neut. No.,	0.0 0.07 0.10 0.14 0.15	Data	Sludge in oil: 200-mes Cen	Tube deposits: Below oil level At and above oil level	Sample temperature, *F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°E	5.36 5.51 5.64 5.66 5.76	Test Cell Data	Sludge	Tube	Sample temp Sample volun Air rate, lit Condensate
100°F Vis Increase, %	4.6.2 8.6 4.0			-	Lt tan Lt yellow Lt yellow Brown NC
Vis, cs/100°F	28.76 29.96 30.55 31.23	ata	Weight change, mg/cm²; Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pirting, or etching: Al Ti Ag Steel
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight cha		Metal disc pitting, o

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TABLE 112. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-26 AT 385°F

		1	;	;			Overhead Sample	ample	
	Vis, cs/100°F	Increase, %	Vis, cs/210°F	mg KOH/g	Overhead Wt, g	Oil Loss,	Acidity, mg KOH/g ci	V1S, CS/100°F	
	12.77	ţ	3.10	0.33	1				
	16.33	27.9	3.62	0.24	49.6				
	18.21	42.6	3.88	0.29	65.7	•			
	22.74	78.1	4.48	0.36	86.7				
	26.70	109	4.97	0.41	92.3	. 54	1.37	9.39	
			Normal	l Electro-					
21	Metal Specimen Data		Clean-up	p cleaned	Test Cell Data	II Data			
بد	Weight change, mg/cm2:		0.0	-0.06	Sludg	Sludge in oil:	200-mesh filter	None	
)		0.0)		Centrifuge	Trace	
		Ag	90.0-				•		
		Steel	0.0	-0.02	Tube	Tube deposits:	Below oil level	Lt var	
		Cn	-0.28	-0.36		•	At and above oil		
		$M_{\mathbf{g}}$	+0.20	÷0.0 6			level	l None	
ਰ	liscoloratic	Metal discoloration, deposits,			Test Conditions	nditions			
C	pitting, or etching:	ing: Al	Lt yellow						
)		Lt tan		Samp	Sample temperature,	, FI	385	
		Ag	Lt yellow		Samp	Sample volume, ml		200	
		Steel	Brown-yellow	llow	Air r	Air rate, liter/hr		130	
		Cu	Brown		Conde	Condensate return		No	
		Mg	Yellow						

TABLE 113. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-64-26 AT 285°F

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		Via, cs/100°F	Inc	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KCH/g	Neut, No., mg KOH/g	Oil Loss,	8 1
	Initial	12.77		ŧ \$	3, 10	Ö	0, 33		
	16 hr	16, 38		28, 3	3,63	Ö	, 26		
	24 hr	18.28		43.1	3,90	0	. 26		
	40 hr	22.76		78.2	4.47	Ö	0.34		
	48 hr	26.32	~	106	4.92	Ö	0.47	52	
~- Ì	al Specimen Data	Jata			Test Cell Data	ata			
	W ght ch	ght change, rng/cm2;	ΑI	+0,06	Sludge in oil:	n oil:	200-mesh filter	h filter	None
			Ti	0.0	•		Cen	Centrifuge	Trace
			Ag	-0.02					
			Steel	-0.04	Tube deposits:	posits:	Below oil level	l level	None
			Cn	-0,35			At and above oil	oove oil	
			Mg	+0.06				level	None
	Metal disc	Metal discoloration, deposits,	sits,		Test Conditions	ions			
	pitting,	pitting, or etching:	₹	Lt yellow					
	•)	. .	Lt tan	Sample	Sample temperature,	ture, 'F		385
			Ag	Lt yellow	Sample	Sample volume, ml	ml	20	00
			Steel	Yellow-brown	Air rate	Air rate, liter/hr	hr	13	130
			C _u	Slight pitting Yellow	Conden	Condengate return	ırn	×	80 60
			D						

TABLE 114. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-64-26 AT 390°F

	V18,	100°F Vin Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Overhead Wt, g	Oil Loss,	Overhead Sample Acidity, Vis, r.ig KOH/g cs/100	Sample Vis,
Initial 16 hr 24 hr 40 hr	12.77 16.75 18.89 24.19 29.04	31.2 47.9 89.4 127	3, 10 3, 76 4, 02 4, 67 5, 28	0.33 0.28 0.33 0.39	53.7 71.2 93.2 98.9	58	1.26	9.26
Metal Spe	Metal Specimen Data			(~1	Test Cell Data	ıta		
Weight	Weight change, mg/cm ² :		+0.02 0.0	2 7	Sludge in oil:		200-mesh filter Centrifuge	None Trace
		Ag Ster 1 Cu Mg	40.0+ 40.0- 0.0-	4 4 6	Tube deposits:		Below oil leve! At and above oil level	None level None
Metal	discoloratio	depos	;		Test Conditions	one		
pliti	pitting, or etching:	ing: Al Ti Ag Steel Cu Mg	Lt yellow Lt tan Lt yellow Brown-yellow I t yellow	« ellow	Sample to Sample v Air rate, Condense	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate retura	φ. •	390 200 130 No

TABLE 115. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-1 AT 385°F

Sample Data

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Oil Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	14.91 15.76 16.13 40.18 94.18	5.7 8.2 169 532	3.76 3.92 3.96 6.90 12.90	0.07 0.3i 0.56 22.0 26.2	18.4 27.0 53.7 61.9	4 ሊ	28.3	9.75
Metal Spe	Metal Specimen Dasa		Normal Clean-up	Electro-	Test Cell Data			Tes.
Weight	Weight change, mg/cm ² :	g/cm ² : Al Ti		-0.06	Sludge in oil:	200-m	200-mesh filter Centrifuge	None
		Ag Steel Cu Mg	0.0 0.0 -4.62 -0.08	0.0 0.0 -4.65 -0.12	Tube deposits:		Below oil level At and above oil level	Lt var el None
Metal pitti	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al	NC		Test Conditions	, , ,	ە. « «	
		Ag Ag Steel Cu Mg	Lt tan Lt yellow Blue Severe etch NC	-ct	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	rature, ne, ml r/hr eturn		

TABLE 116. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-55-1 AT 385°F

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Vis, 100°F Vis Vis, Neut. No., Oil Logs.	cs/100°F Increase, % cs/210°F mg KOH/g wt %		15,75 5,6 3,91	16,15 8,3	40,97 175 7,00 2	110.2 639 14.22	imen Data	Weight change, mg/cm²: Al 0.0 Sludge in oil: 200-mesh filter None Ti -0.02 Centrifuge Trace Ag 0.0	-3,73	90,0+	Metal discoloration, deposits, Ditting, or etching:	Ti Lt t	Lt yellow Sample volume, mi	 blue Air rate, liter/hr
	CB	Initial	16 hr	24 hr	40 hr		Metal Specimen Data	Weight change,			Metal discolora	10		

TABLE 117. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-1 AT 390°F

Sample Vis, cs/100°F	10.00		None Trace	None Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	29.39		200-mesh filter Centrifuge	Below oil level At and above oil level	390 200 130 No
Oil Loss, wt %	90	انس	200-r		is iperature, °F ume, ml iter/hr return
Overhead Wt, g	22.3 32.6 64.9 69.9	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.07 0.42 0.85 24.3 21.5	H1			
Vis, cs/210°F	3.76 3.92 3.97 11.01 32.79		+0.02 0.0 -0.04	+0.04	NC Lt tan Lt yellow Blue Severe etch
100°F Vis Increase, %	6.4 8.8 391 2402			Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	14.91 15.86 16.22 73.23 373.0	Metal Specimen Data	Weight change, mg/cm ² :	c	etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spe	Weight		Metal o

TABLE 118. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-2 AT 385°F

	Vis.	100°F Vis	Vis.	Neut. No.	Overbead	Oil Loss.	Overhead Sample	Sample
	cs/100°F	Increase, %	CB	mg KOH/g	Wt, g	wt %	mg KOH/g	cs/100°F
Initiai	13,34	!	3.10	0.64	:			
16 hr	14,40	7.9	3,31	0.10	41.9			
24 hr	15,27	14.5	3.42	0.08	60.4			
40 hr	17.86	33.9	3.82	0.42	88.0			
48 hr	19,96	49.6	4.11	0.09	94.5	25	06.0	11,57
			Normal	Electro-				
Metal Spe	Metal Specimen Data		o l		Test Cell Data			
Weight	Weight change, mg/cm2:		-0.02	-0.06	Sludge in oil:	: 209-mesh filter	h filter	None
		Ti	-0.04	-0.04		Cer	Centrifuge	1.4m1/25
		Ag	-0.02	-0.06			,	
		Steei	0.0		Tube deposits; Below oil level	s: Below o	l level	None
		on O	-0.41	-0.43		At and a	At and above oil level None	l None
		Mg	+0.10	+0.10				
Metal c	liscoloration	Metal discoloration, deposits,		Tes	Test Conditions			
pittir	pitting, or etching:	ng: Al	NC					
		T_i	Lt tan	V)	Sample temperature,	erature, °F	F 385	
		Ag	Lt yellow	U)	Sample volume, ml	ne, ml	200	
		Steel	Lt tan	7	Air rate, liter/hr	er/hr	130	
		Cn	Pits	•	Condensate return	return	No	
		M S	NC					

TABLE 119. RESULTS OF REFLUX OXIDATION-CORROSION TEST CN O-65-2 AT 385°F

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		None Trace None None	
Oil Loss, wt %	55	nesh filter Centrifuge v oil level d above oil level	385 200 130 Yes
Neut. No., mg KOH/g	0.64 0.08 0.10 0.08 0.06	Sludge in oil: 200-mesh filter Centrifuge Tube deposits: Below oil level At and above oil	t Conditions Sample temperature, *F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F	3. 10 3. 31 3. 45 3. 84 4. 16 Test Cell Data	Sludge Tube o	Test Conditions Sample temp Sample volu Air rate, lit Condensate
100°F Vis Increase, %	8.0 15.2 35.2 50.7	0 0 -0.05 +0.04 -0.0-0.01	Lt yellow Lt tan Lt yellow Lt tan Pits NC
H		2. Al Ti Ag Steel Cu Mg	posits, Al Ti Ag Steel Cu Mg
Vis, cs/100°F	13.34 14.41 15.37 18.04 20.13	Weight change, mg/cm ² :	Metal discoloration, deposits, pitting, or etching: Ti Ag Stee
	Initial 16 hr 24 hr 40 hr 48 hr	Weight ch	Metal dispitting,

TABLE 120. RESULTS OF NONAEFLUN OXIDATION-CORROSION TEST ON O-65-2 At 390°F

(L)	7:		i i			
Vis,	11.57		None Insufficient sample	None None		
Overhead Sample Acidity, Vis, mg KOH/g cs/100	0.92			i level		390 200 130 No
Oil Loss, wt %	09		200-mesh filter Centrifuge	Below oil level At and above oil level		tture, °F ml hr irn
Overhead Wt, g	47.5 68.0 96.1 101.5	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.64 0.09 0.06 0.06	Test C	Slud	Tub	Test Co	Sam Sam Air Conc
Vis,	3.10 3.41 3.49 3.97 4.36		0.0	+0.02 -0.45 -0.04	U	Lt tan Lt yellow Lt tan Pits NC
100°F Vis Increase, %	9.2 17.5 41.5 60.4		y/cm ² : Al Ti	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching:	
Vis,	13.44 14.57 15.67 18.88 21.40	Metal Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:	ı
	Initial 16 hr 24 hr 40 nr 48 hr	Metal Spec	Weight		Metal o	

RESULTS OF NONREFLUX OXIDATION-COI ROSION TEST ON 0-65-3 AT 385°F TABLE 121

Sample Data

	Via, cs/100°F	100°F Vis Increase, %	Vis. cs/210°F	Neut. No., mg KOH/g	Overhead Wt. g	Oil Loss,	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis,
Initial	17.05	!	4.52	0.24	\$ 1			
16 hr	19,48	14.2	5.04	0.68	42.2			
24 hr	21,51	26.2	5.51	0.85	61.0			
40 hr	33.04	93.8	8.14	1.27	93.4			
48 hr	71.48	319	16.08	2.01	102.4	64	1.58	10.73
Metal Spe	Metal Specimen Data			Te	Test Cell Data			
Weight	Weight change, mg/cm2;		-0.12		Sludge in oil:		200-mesh filter	None
		T_i	-0.12		,	O	Centrifuge	(a)
		Ag	-0.04)	•
		Steel	-0.02		Tube deposits:		Below oil level	None
		Cn	-0.10				At and above oil level	
		Mg	+0.10					
Metal c	discoloratio	Metal discoloration, deposits,		Ţ	Test Conditions	α		
pittir	pitting, or exching:		Lt rose			ı		
			Lt purple		Sample temperature,		°F 385	10
		Ag	Lt orange		Saraple volume, ml	ıme, ml	200	0
		Steel	Blue-green	u	Air rate, liter/hr	ter/hr	130	-
		Ω Q α	Green-brown Lt brown	uwo	Condensate return	return	°Z	
		0						

(a) Insufficient sample.

TABLE 122. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-55-3 /T 385*F

Data	
Sample	

• .		None (a) None Lt. var	
Oil Loss, wt %	09	lter uge vel	level 385 200 130 Yes
Neut, No., mg KOH/g	0.24 0.65 0.84 1.29 1.83	Sludge in oil: 200-mesh filter Centrifuge Tube deposits: Below oil level At and above oil	perature, °F me, n.l er/hr relurn
Vis, cs/210° F	4.52 5.00 5.46 7.56 14.24 Test Cell Data	Sludge Tube d	Test Conditions Sample temp Sample volu Air rate, liu Condensate
100 F Vis	 14.1 23.9 81.1	-0.04 -0.08 -0.02 -0.02	+0,02 Lt rose Lt purple Lt orange Blue-green Green-brown
1) Inc	14 23 23 81 271		Mg sits, Al Ti Ag Steel Cu Mg
Vis, cs/100°F	17.05 19.46 21.12 30.88 63.26	ange, mg/cm ² ;	Metal discoloration, depos pítting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr Metal Specimen Data	Weight change,	Metal disc pítting, c

(a) Insufficient sample.

TABLE 123, RESULTS OF NONREFLUX OXIDATION-CORROSION IEST ON O-65-4 AT 185°F

Sample Data

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis,
Initial	27.92	7. 1	5,28	0.15	ı			
16 hr	30.77	10.2	5,66	0.37	0.7			
24 hr	31,33	12.2	5.72	0.38	1.1			
40 hr	32.13	15.1	5.80	0.42	1.9			
48 hr	32,33	15.8	5.86	0.50	2.3	6	(a)	(a)
tal Spe	Metal Specimen Data		Normal Clean-up	Electro- cleaned I	Test Cell Data			
Weight	Weight change, mg/cm2:	g/cm ² : Al	0.0	0.0	Sludge in oil:		00-mesh filter	None
			-0.08	-0.08			Centrifuge	None
		A.	0.0	-0.0 4				
		Steel	-0.02	-0.04	Tube deposits:		Below oil level	None
		o C	-0.26	-0.26	_		At and above oil level	rel None
		M 8	+0.14	+0.12				
Metal c	discoloratio	depoi	2	H	Test Conditions	wo l		
IT : 1.C.	of ing, or etching:	ng: Al Ti	I tal		Sample temperature.		.F 385	
		: 85 5 7	Lt yellow		Sample volume, ml		200	
		Steel	Blue		Air rate, liter/hr	ter/hr	130	
		n O	Brown		Condensate return	return	No	
		c !)					

(a) Insufficient sample,

TABLE 124. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-65-4 AT 385°F

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	Vis.	oul oul	100°F Vis Increase, %	Vis, cs/210°E	Neut, No., mg KOH/g	Oil Loss, wt %	
Initial	27.92		!	5, 28	0,15		
16 hr	30,84		10.5	5,67	0,35		
24 hr	31,35		12.3	5.72	0,35		
40 hr	32,11		15.0	5,83	0.40		
48 hr	32,21		15.4	5.86	0.45	6	
Metal Specimen Data	ata			Test Cell Data	Data		
Weight cha	Weight change, mg/cm ² ;	Z II	-0.02	Sludge	Sludge in oil: 200-me Ce	200-mesh filter Centrifuse	None
		A S	+0.06) C	
		Steel	+0.02	Tube d	Tube deposits: Below oil level	il level	None
		Cn	-0.32			At and above oil	
		Μ æ	-0.02			level	None
Metal disc	Metal discoloration, depo	omita,		Test Conditions	itions		
pitting,	pitting, or etching:	₹	UZ				
	;	Ī	Lt tan	Sample	Sample temperature, *F		
		Ag	UZ	Sample	Sample volume, ml	200	
		Steel	Blue	Air rat	Air rate, liter/hr	130	
		Cu	Pits	Conden	Condensate return	Yes	
		Σ	NZ CZ				

TABLE 125, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-4 AT 390°F

Sample Data

							Overhead Sample	Sample
	V18,	IOC.F Vis	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
			-					
Initial	27.92	1	5.28	0.15	1			
16 hr	31.00	11.0	5.67	0.38	1.0			
24 hr		13.0	5.74	0.40	1.5			
40 hr		16.2	5,85	0.47	2.5			
48 hr	32.97	18.1	5.91	0.48	3.0	01	4.88	22 20
Metal Spe	Metal Specimen Data			Ηİ	Test Cell Data	es I		
Weight	Weight change, mg/cm ² :	g/cm ² : Al	0.0		Sludge in oil:		200-mesh filter	None
	•	-	-0.02			•	Centrifuge	None
		Ag	-0.05					
		Steel	+0.0+		Tube depor	Tube deposits: Below oil level	oil level	None
		on O	-0.28			At and	At and above oil level	el None
		Mg	-0.04					
Metal	discoloratio	Metal discoloration, deposits,		H	Test Conditions	118		
pitti	pitting, or etching:	ing:	S					
•			Lt tan		Sample temperature,	nperature,	•F 390	
		A	Yellow		Sample volume, ml	ume, ml	200	
		Stee1	Blue		Air rate, liter/hr	iter/hr	130	
		Ö	Brown		Condensate return	return	o N	
		Σ 30	UZ					

TABLE 126. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-65-5 AT 385*F

	Vis, cs/100'F	100°F Vis	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, B	Oil Loss,	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	19.44 22.24 22.87 23.99 25.42	14.4 17.6 23.4 30.8	4.03 4.42 4.52 4.72 4.86	0.15 0.26 0.28 0.28 0.30	41.9 60.4 88.0 94.5	27	06.0	11.57
Metal Spe	Metal Specimen Data		Normal Clean-up	Electro-	Test Cell Data	 1		
Weight	Weight hange, mg/cm ² ;		-0.02	-0.02 -0.06 -0.08	Sludge in oil:	200 - r	200 -mesh filter Centrifuge	None None
		Sterl Cu Mg	-0.02 -0.79 -0.79	-0.04 -0.83 +0.12	Tube depos	Tube deposits: Below oil level At and above oi	Below oil level At and above oil level	None el None
Metal o	etal discoloration, pitting, ör etching	Metal discoloration, deposits, pitting, or etching: Ti Ag Steel	NC Lt tan Lt yellow Blue Brown	()	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	nperature, ume, ml iter/hr return	*F 385 200 130 No	

TABLE 127, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-65-5 AT 385*F

Sample Data		
sample Dat	•	
sample Da	ب	
sample D	:\$	
I eldring		
armple	-	
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3.44.1		
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	V	100 Incre	100°F Vim	Vis,	Neut. No.,	Oil Loss,	
Initial	19.44	•	:	4.03	0, 15		
16 hr	22,21	4	14.2	4,43	0.29		
14 40	22.89	17	. 7	4,52	0.27		
40 hr	24.44	25	25.7	4.71	0, 31		
48 hr	25.57	31	.5	4,86	0,31	27	
Metal Specimen Data	Jata			Test Cell Data	Data		
Weight cha	Weight change, mg/cm2;		20.02	Sludge in oil:		200-mesh filter	None
		- + - X	-0.06 +0.06		<u>.</u>	Centriluge	None
		c1	0.0	Tube d	Tube deposits: Below oil level	il level	None
		, 0,	0.81		_	At and above oil level	None
		Mg	0.0				
Metal diac	Metal discoloration, depo-	#its,		Test Conditions	tions		
pitting,	pitting, or etching:		NC				
	1	Ti	Lt tan	Sample	Sample temperature, 'F	385	
		æ<	ZC	Sample	Sample volume, mi	200	
			Blue	Air rat	Air rate, liter/hr	130	
		Cu	Fite	Conden	Condensate return	Yes	
		M.	NC				

TABLE 128, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-5 AT 390°F

Sample Data

Overhead Sample Acidity, Vis, g KOH/g cs/100°F	17.26		None None	None level None	390 200 130 No
Overhead Acidity, mg KOH/g	1.80		200-mesh filter Centrifuge	Below oil level At and above oil level	[14 0
Oil Loss, wt %	32	ata			Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	18.7 27.7 44.4 51.7	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temp Sample volur Air rate, lit Condensate
Neut. No., mg KOII/g	0.15 0.31 0.31 0.30				>
Vis, cs/210°F	4, 03 4, 45 7, 55 7, 03			-0.04 +0.04 -0.87 -0.12	NC Lt tan Lt yellow Brown
100°F Vis Increase, %	15.3 19.2 29.6 38.2		g/cm ² : Al Ti	Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis.	19.44 22.41 23.18 25.20 26.87	Metal Specimen Data	Weight change, mg/cm:		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spe	Weight		Metal pitti

TABLE 129. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-65-8 AT 385°F

Sarapie Data

Sample Vis, cs/100°F	17.36		None Trace	None rel None	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1,51		200-mesh filter Centrifuge	Below oil level At and above oil level None	385 200 130 No
Oil Loss,	16	‡	200-1		erature, nc, ml er/hr eturn
Overhead Wt, g	5.3 7.9 12.5 14.4	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.01 0.08 0.15 0.19	E į			!-1
Vis, cs/210°F	4.08 4.12 4.16 4.32 4.26		+0.02 +6.04 +0.02	+0.02	NC Lt tan NC Lt blue Orange NC
100°F Vis Increase, %	2.5 3.9 5.7 7.6		//cm ² : Al Ti Ag	Steel Cu Ng	Metal discoloration, deposits, pitting, or etching: fi Ag Staal Cu
Vis, cs/100°F	19.07 19.54 19.82 20.16 20.52	Met. 1 Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching
	Initial 16 hr 24 hr 40 hr 48 hr	Met. 1 Spec	Weight		Metal d pittin

TABLE 130. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-65-8 AT 385'F

	Vis,	100°E Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Acidity, Vis, g KOH/g cs/100°F
	19.07	i i	4.08	0.01	£ •			
	19.58	2.7	4. 4.	80.0	4, 4 5			
	1.7.1.3	ະ ຕ	4. I.U	0.10	7.5			
	20.19	5,9	4.22	0, 19	4.	•	1	1
48 hr	20, 52	7.6	4,26	0.20	10.8	્ર	1.32	17.54
pecim	Metal Specimen Data			Test Ce	Test Cell T ta			
ht ch	Weight change, mg/cm2.		0.0	Slud	Sludge in oil:	200-mesh filter Centrifuge	lter fuge	None 0.05 ml/25
		Ag Steel	0.0	Tube	Tube deposits:	Below oil level	vel	None
		r C	-0.10			At and above oil level None	e oil level	None
		Mg	0.0					
l disc	coloratio	Metal discoloration, deposits,		Test Co	Test Conditions			
ting,	pitting, or etching:	ng: Al	ひと					
•			Lt tan	Sam	Sample temperature,	ture, 'F	385	
		Ag	UZ	Sam	Sample volume, ml	ml	200	
		Steel	Blue	Air	Air rate, liter/hr	hr	130	
		ű	Orange	Conc	Condensate return	ırı	No No	
		Mg	S					

TABLE 131, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-65-8 AT 365°F

ata	
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(V)	i

Oil Loss, wt %	15		None 0, 05 ml/25	lyone el None		ω Ο ο ∞
Neut. No., O mg KOH/g	0.01 6.08 6.13 0.21		200-mesh filter Centrifuge	Below oil level None At and above oil level None		ature, °F 385, rnl 200 lhr 130 vrn Yes
Vis, cs/210°F	4. 06 4. 11 4. 23 4. 26	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
100°F Vis Increase, %	2.6 3.7 7.5			-0.02 -0.02 0.0	Ŋ	Lt tan NC Blue Orange NC
描			सः	Steel Cu Mg	osits, Al	Ti Ag Steel Cu Mg
Vis,	19.07 19.56 19.78 20.19 20.50		, mg/cm²		ration, dep tching:	
•	Initial 26 hr 24 hr 49 hr 48 hr	Metal Specimen Data	Weight changs, mg/cm ² ;		Metal discoloration, deposits, pitting, or etching: Al	

TABLE 132. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-14 AT 385°F

							Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss,	Acidity, mg KOH/g	Vis, cs/100°F
initial	17.71	ŧ	4.67	0 , 24	!			
16 hr	19.57	10.5	5.08	0.70	39.1			
24 hr		50.9	5.47	0.88	56.8			
40 hr		30,3	5.29	10.12	88.2			
48 hr	_	577	16.04	58.9	101.7	60	5,55	10.64
Metal Spe	Metal Specimen Data			Ter	Test Cell Data			
Weight	Weight change, mg/cm ² :		-0, 18		Sludge ir oil:	200-n	200-mesh filter	None
		Ti	-0.12			ပီ	Centrif. ge	(a)
		Ag	-0.08					
		Steel	+0.07		Tube deposits:		Below oil level	Med var
		Cu	-0.10				At and above oil level	Med var
		Mg	-0.16					
Metal	discoloratio	Metal discoloration, deposits,		Te	Test Conditions			
pitti	pitting, or etching:	ing: Al	S					
			Blue-green		Sample temperature,	erature, °F	F 385	
		Ag	Lt yellow		Sample volume, ml	ne, ml	200	
		Steel	Peacock		Air rate, liter/hr	er/hr	130	
		Cu	Lt brown		Condensate return	return	Ν̈́	
		Mg	Lt pitting					

(a) Insufficient sample.

TABLE 133, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-65-14 AT 385°F

Oil Loss, wt %		filter None ifuge (a)	evel Med var ve oil level Med var	385 200 130 Yes
Neut, No., mg KOH/g 0.24 0.66 0.84 13.19 30.7		in oil: 200-mesh filter Centrifuge	posits: Below oil level At and above oil level	f Conditions Sample temperature, F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F 4.67 5.01 5.36 5.15 14.01	Test Cell Data	Sludge in oil:	Tube deposits:	Sample temp Sample volun Air rate, lit Condensate
100°F Vis Increase, % 9.5 17.9 30.2 452		Al -0.10 Ti -0.08 Ag -0.04	Steel +0.02 Cu -0.04 Mg 0.0	Al NC Ti Blue-green Ag Lt yellow Steel Peacock Cu Lt brown Mg Lt brown
Vis, cs/100°F 17.71 19.40 20.88 23.05 97.83	Data	Weight Nange, mg/·m²t / T	ν O Σ	Metal discoloration, deposits, pitting, or etching: Ti Ag Stee
Initial 16 hr 24 hr 40 hr	Me al Specimen Data	Weight		Metal dis

(a) Insufficient sample

TABLE 134, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON D.65-15 AT 385°F

Sample Vis, cs/100°F	23.20		None None	None 1 None	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	3.65		200-mesh filter Centrifuge	Below oil level At and above oil level None	*F 385 290 130 No
Oil Loss, wt %	Ξ	e l	200-0		erature, ne, ml er/hr eeturn
Overhead Wt, g	2.8 4.0 5.6 4.0	Fest Cell Data	Sluage in oil:	Tube deposits:	Test Conditions Sample temperature Sample volume, m Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.02 0.18 0.33 6.12 0.45	드			
Vis.	5.64 5.29 5.38 5.52 5.61		0.0	0.0 0.0 .0.04 +0.06	NC Fan NC Blue-green Orange-green
100°F Vis Increase %	9.4 9.4 13.3			Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Ti Ag Ste. 1 Cu
Vis.	27.20 29.11 29.76 30.82 31.48	Metal Specimen Data	Weight change mg/cm ² :		stal discoloration, spitting, or etching;
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spec	Weight		Metal

TABLE 135, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-65-15 AT 385*F

			None None	None None	
Oil Loss,	11		mesh filter Centrifuge	below oil level At and above oil level	385 200 130 Yes
Neut, No.,	0.02 0.20 0.30 0.42 0.45	Data	200-1	tube deposits: Below oil level At and above oi	t Conditions Sample temperature, *F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F	5.04 5.29 5.40 5.52 5.63	Test Cell Data	Sludge in oil:	n nge d	₩
100°F Vig Increase, %	7.1 9.7 12.4 16.1		0.0		NC Lt tan NC Blue-green Orange-green
			AR AR	Ou Mg	Al Al Ti Ag Steel Cu Mg
Vis, cs/100°F	27.20 29.13 29.85 30.56	ata	Weight change, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Al Ag Ag Stee
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight cha		Metal disc pitting, c

TABLE 136. RESULTS OF NONREFLUY OXIDATION-CORROSION TEST ON O-65-16 AT 385°F

	:		į	;		•	Overhead Sample	Sample
	V18,	Increase, %	Vis.	Meut. No.,	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
Initial	20.69	i 1	5.13	0.20	;			
16 hr		7.3	41	0.20	2.1			
24 hr	29.23	9.5	5.45	0.31	2.8			
40 hr		13.3	5.59	0.48	5.9			
48 hr	30,82	15.5	65.5	0.54	4.3	6	7.01	20.23
Metal Spe	Metal Specimen Data			H۱	Test Cell Data	Į.		
Weight	Weight change, mg/cm2;		0.0		Sludge in oil:		200-mesh filter	None
ì	;	1.1	0.0)		Centrifuge	None
		AR	0.0)	
		Steel	0.0		Tube deposits:		Below oil level	None
		Cu	0.0		•		At and above oil level	
		M	+0.0+					
Metal	ancoloratio	Metal ancoloration, deposits,		I	Test Conditions	ans.		
pitti	pitting, or etching:	ng: Al	NC	1				
		Ti	Lt tan		Sample te	Sample temperature,	•F 385	
		Ag	S		Sample volume, ml	lume, ml	200	
		Steel	Blue		Air rate, liter/hr	liter/hr	130	
		Cu	NC		Condensate return	e return	°Z	
		M8	Orange					

TABLE 137. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-65-16 AT 385*F

	Vim, cm/100°F	100°F Vis Increase, %	Vie, ce/210°F	Neut. No., mg KOH/g	Oil Loss,	
Initial 16 hr 24 hr 40 hr 48 hr	26.69 28.62 29.26 29.95 30.84	7.2 9.6 12.2 15.5	5. 13 5. 39 5. 47 5. 56	0.20 0.21 0.31 0.51	10	
Metal Specimen Data	it a		Test Cell Data	Jata		
Weight chan	Weight change, mg/cm ² ;	Al 0.0 Ti +0.04 Ag -0.02	Sludge in oil:	200-1	mesh filter Ceatrifuge	None
		Steel 0.0 Cu 0.0 Mx +0.02	Tube do	Tube deposits: Below oil level At and above oi	Below oil level At and above oillevel	No
Metal discoloration, pitting, or etching:	depo	Al NC Ti Lttan Ag NC Steel Blue Cu Orange	Sample temp Sample volus Air rate, lit Condensate	t Conditions Sample temperature, *F Sample volume, m! Air rate, liter/hr Condensate return	385 200 130 Yes	

TABLE 138, RESULTS OF NONREFLUX ONIDATION-CORROSION TEST ON O-65-18 AT 385*F

Sample Data

							1	; ;
	V18,	100°F V.s Increase, %	ViB, C8/210°F	Neul. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, Vis, mg KOH/g cs/100	Vis, Cs/100°F
Initial	17.55	1	4.61	0.21	ţ			
16 hr	19.68	12.1	5.06	0.72	38.6			
24 hr	21.59	23.0	5.50	0.81	55.2			
40 hr	29.19	66.3	7,10	1,23	83.0			
48 hr	43,59	148	10.06	1.85	92.2	69	1.87	10.91
Metal Spe	Metal Specimen Data			Test	Test Ceil Data			
Weight	Weight change, mg/cm2;		0.0	is.	Sludge in gilt	200 mach filter	filter	Z
		Γ_1	+0.02	?			Centrifice	None
		Α×	0.0				9	21011
		Steel	0.0	Ę	Tube deposits:	Below oil level	1100	Dark war
		Cr	-0,12	•			At and above oil level	Dark yar
		M	0.0				TO THE TOTAL	Dain val
Metal c	discoloration	Metal discoloration, deposits,		Test	Test Conditions			
pitti	pitting, or etching:	ng: Al	Lt yellow					
		Ţ	Brown	Š	Sample temperature,	rature, °F	385	
		Ax	Lt yellow	Š	Sample volume, ml	e, ml	700	
		Steel	Blue	V	Air rate, liter/hr	r/hr	130	
		Cu	Brown & green		Condensate return	turn	Z	
		M	Yellow)	

TABLE 139, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-65-18 AT 385*F

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Oil Loss, wt %	₹		None None	Lt var Lt var	395 200 130 Yes
Neut, No., Oil mg KOH/g	0.21 0.72 0.79 1.1) 1.68	Data	Sludge in oil: 200-mesh filter Centrifuge	Tube deposits: Below oil level At and roove oil	Sa ple temperatus, 'F' ample volume, ml Air rate, iter/'.
Via,	4 61 4.96 5.33 6.79 9.40	Fest Cell Data	Sludge	Tube	T e
100 F Vis	10.0 19.2 57.7 i.29		0.0	0.0	Lt yellow Brown Lt yellow Blue Lt green & yellow Yellow
Vis,	17.55 13.31 20.92 27.67 40,21	.	e, rng/c2; Al Ti	Ster1 Co Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Ag Ag Mag Steel
	16 hz 24 hr 40 hr 46 hr	Metal Specimer Data	Werg tchange, rng/cm2;		Metal discoloration, pitting, or etchlug:

TABLE 140. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-19 AT 385°F

Sample Vis, cs/100°F	9.18		None None Lt var	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1.68		200-mesh filter Centrifuge Below oil level At and above oil level	385 200 130 No
Oil Loss, wt %	45		** m	perature, °F ume, ml ter/hr return
Overhead Wt, g	37.7 52.3 72.2 76.3	Test Cell Data	Sludge in oil: Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g	0.25 0.57 0.72 1.02 1.29	1		
Vis, cs/210°F	4.15 4.44 5.29 5.85		0.0 -0.04 -0.18	Lt yellow Brown Lt yellow Blue Brown & green
100°F Vis Increase, %	- 1.3 + 8.3 +37.6 +58.9		y/cm ² ; Al Ti Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	17.72 17.49 19.19 24.38 28.15	Metal Specimen Data	Weight change, mg/cm ² ;	etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr	Metal Spec	Weight	Metal c

TABLE 141. RESULTS OF REFLUX OXIDATION. CORROSION TEST ON O-65-19 AT 385°F

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut, No., mg KOH/g	Oil Loss, wt %	
Initial 16 hr 24 hr 40 hr	17.72 19.09 20.45 25.52 26.21	7.7 15.4 44.0 47.9	4.67 4.91 5.25 6.32 5.82	0. 25 0. 71 0. 82 1. 08 10. 49	7.5	
Metal Specimen Lata	ata		Test Cc'l Data	ıta 		
Weight cha	Weight change mg/cm ² : 7	Al 0.0 Ti 0.0 Ag -0.02	Sludge in oil:	200-1	mesh filter Centrifyge	None None
	on O Z	Steel 0.0 Cu -0.12 Mg +0.08	Tube deposits:		Below oil level At and above oil level	Lt var Lt var
Metal Secondary	Metal Mercolomation, deposits, pitting, or etching: Ti Ag Stee	Al Lt yellow Ti Brown & blue Ag Lt yellow Steel Blue Cu L green & yellow Mg Yellow	-1 es	t Conditions Sample temperature, "F Sample volume, ml Air rate, liter/hr Condensate return	385 200 130 Yes	

TABLE 142. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-21 AT 885°F

	· communication control of the contr						Overhead Sample	Sample
	Vis, cs/100°F	100°F Vis Increase, %	Vis,	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
Initial	15.11	† †	3.76	0.07	1 1 2			
16 hr	17.34	14.8	4.13	0, 63	35.2			
24 hr	18.92	25.3	4,39	0.73	48.9			
40 hr	23.48	55.4	5, 13	96.0	68.5			,
48 hr	26.54	75.6	5,67	٠ د، د	73,1	45	1.82	9.12
Metal Spe	Metal Specimen Data			Te	Tes: Cell Data	.1		
Weight	Weight change, mg/cm2:	g/cm ² : Al	0.0		Sludge in oil:	200-r	200-mesh filter	None
))	Ti	+0.02	61		J	Centrifuge	None
		Ag	-0.0-	webs				,
		Steel	0.0		Tube deposits:		Below oil level	
		Cu	-0.16	S		At and	At and above oil level	rel Lt var
		Mg	-0.04	4				
Metal	discoloratic	Metal discoloration. deposits,		T	Test Conditions	<u>8</u>		
pitt	pitting, or etching:	hing: Al	Lt yellow					
•)	Ti	Brown		Sample temperature,	perature,	.F 385	
		Ag	Lt yellow		Sample volume, ml	ume, ml	200	
		Steel	Blae		Air rate, liter/hr	iter/hr	130	
		c C	Brown & green	green	Condensate return	return	N _o	
		% 8	N					

TABLE 143. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-65-21 AT 385°F

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751	i

Oil Loss,	7 ti		None None	Dark var Dark var	385 200 130 Yes
Neut, No., Oil Los mg KOH/g wt %	0.07 0.76 0.82 1.21 26.4 54		l: 200-mesh filter Centrifuge	its: Below oil level At and above oil level	perature, °F ume, ml ter/hr return
Vis, CS/210°F	3.76 4.93 5.22 6.06 7.51	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
100°F Vis Increase, %	26.3 34.7 62.0			Steel C.0 Cu -0.27 Mg -0.73	Al Lt yellow Ti Brown & blue Ag Lt yellow Steel Blue Cu Orange Mg Yellow & pitted
Vis,	15.11 19.08 20.36 24.48 41.36	Data	Weight change, mg/cm ² : Al Ti	Stee Cu Mg	Metal discoloration, deposits, pitting, or ecching: Ti Ag Stee
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight ch		Metal dis. pitting,

TABLE 144. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-65-23 AT 385°F

Sample Data

							Overhead Sampic	Sampio
	Vis, cs/100°F	100°F Vis Increase, %	Vis,	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, mg KOH/g	Vis, cs/100°F
Initial	12,62	\$ •	3.15	0.20	i			
16 hr	17.34	37.4	3.87	0.32	53.0			
24 hr	20.50	62.4	4.31	0.56	68.5			
40 hr	27.44	117	5.21	0.81	79.4			
48 hr	30.46	141	5,57	0.84	80.1	25	1.13	7.90
Metal Spe	Metal Specimen D ta			H	Test Cell Data	rd !		
Weight	Weight change, mg/cm2:		0.0		Sludge in oil:		200-mesh filter	None
1)		+0.04)		Centrifuge	Trace
		Ag	0.0				1	
		Steel	0.0		Tube deposits:		Below oil level	None
		Cn	-0.02				At and above oil level	vel None
		Mg	0.0					
Metal c	discoloration	Metal discoloration, deposits,		T	Test Conditions	ns		
pittir	pitting, or etching:	ng: Al	NO	İ				
		Ti	Lt tan		Sample ter	Sample temperature,	°F 385	
		₩. ₩	Lt Yellow		Sample volume, ml	lume, ml	200	
		Steel	Peacock		Air rate, liter/hr	liter/hr	130	
		Z Cr	Orange NC		Condensate return	e return	°C Z	
		0						

TABLE 145. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-65-23 AT 385°F

		None Trace None None	
Oil Loss,	9.0	200-mesh filter Centrifuge Below oil level At and above oil level	385 200 130 Yes
Neut. No.,	0.20 0.32 0.56 0.85 0.85	Sludge in oil: 200-mesh filter Centrifuge Tube deposits: Below oil level At and above oil	t Conditions Sample temperature, *F Sample volums, ml Air rate, liter/hr Condensate return
Via, cs/210°F	3.15 3.85 4.28 5.25 5.70 Test Cell Data	Sludge Tube o	Test Conditions Sample temp Sample volu Air rate, lit Condensate
100°F Vis Increase, %	34.9 59.9 120 148	0.0 +0.02 0.0 0.0 -0.04 +0.02	NC Lt tan Lt yellow Feacock Orange
1 4		Ti Ti Ag Steel Cu Mg	osits, Al Ti Ag Steel Cu Mg
Vis, cs/100°F	12. 62 17. 02 20. 18 27. 72 31. 24	ge, mg/cm ² .	oration, dep etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Weight change, mg/cm ² :	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel

TABLE 146, RESULTS OF NONREFLUX OXIDATION-CCRROSION TEST ON O-65-24 AT 385°F

	Vis, cs/100°E	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initia l 16 hr 24 hr 40 hr	15.17 16.04 16.82 18.73 20.35	5.7 10.9 23.5 34.1	3.72 3.84 3.98 4.31 4.58	0.13 0.09 0.21 0.54 0.64	34.2 48.3 70.7 77.9	45	1.07	11.69
Metal Spe	Metal Specimen Data			FI	Test Cell Data	Į.		
Weight	Weight change, mg/cm ² :		0.0		Sludge in oil:		200-mesh filter Centrifuge	Trace Trace
		Steel Cu Mg	0.0 -0.06 +0.04		Tube deposits:		Below oil level At and above oil level	None
Metal	stal discoloration, pitting, or etching:	Metal discoloration, deposits, bitting, or etching:	NC	e-1	Test Conditions	suc		
			Lt tan Lt yellow Blue Orange		Sample temperatus Sample volume, m Air rate, liter/hr Condensate return	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	*F 385 200 130 No	10.00
		Mg	N U					

TABLE 147, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O.65-24 AT 385*F

,088, 9%			Trace Trace None	385 200 130 Yes
Oil Loss,	24		200 -mesh filter Trac Centrifuge Trac Below oil level None	
Neut, No., mg KOH/g	0, 13 0, 09 0, 22 0, 54 0, 62	Data	Sludge in oil: 200 -inesh filter Centrifuge Tube deposits: Below oil level	t Conditions Sample temperature, *F Sample volume, m! Air rate, liter/hr Condensate return
Via, ca/210°F	3.72 3.82 3.95 4.22	Test Cell Data	Sludge Tube o	Test Conditions Sample temp Sample volu Air rate, lit Condensate
100°F Vis Increase, %	5.1 9.8 21.1 30,5		0.000.000000000000000000000000000000000	NC Lt tan Lt yellow Blue Orange NC
⊷ 1			2; Al Ti Ag Steel Cu Mg	Fogits, Al Ti Ag Steel
Vie,	15.17 15.94 16.66 18.37 19.79	Data	Weight change, mg/cm ² ;	Metal discoloration, deposits, Liting, or etching: Ti Ag Ag Stee
	Initial 16 br 24 hr 40 hr 48 hr	Metal Specimen Daia	Weight o	Metal dis

TABLE 148 RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON C-65-27 AT 385°F

Sample Data

	V18,	100°F Vis	V18.	Neut, No.,	Overhead	Oil Loss,	Acidity, Vis,	Vis,
	and the second s			Q				
Initial	15,19	ŧ ;	3.99	0.26	4			
hr	17.14	12.8	4.38	0.60	44.0			
24 hr	18.96	24.8	4.76	0.73	63.0			
40 hr	31,48	107	7.26	1.30	93.4			
48 hr	283.7	1768	43.82	3.48	9.76	63	1.25	10.54
Spe	Metal Specimen Data			Tet	Test Cell Data			
3 पद्धाः	Weight change, mg/cm ² :	g/cm ² : Al Ti Ag	+0.02		Sludge in oil:	200	200-mesh filter Centrifuge	None (a)
		Steel	+0.04		Tube deposits:		Below oil level	Lt var
		Cr	0.0		,		At and above oil level	1 Lt var
		M_{8}	40.20					
tal c	liscouratio	Metal discouration, deposits,		Tea	Test Conditions	on.		
oittir	pitting, or etching	ng Al	Lt yellow			ı		
		्र	Lt brown		Sample temperature,	perature, *F		
		84	Lt yellow		Sample volume, ml	me, ml	200	
		Steel	Blue	٠	Air rate, liter/hr	er/hr	130	
		O	Orange	-	Condensate return	return	°Z	
		Σα	Orange					

(a) Insufficient sample.

TABLE 149, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-65-27 AT 385*F

Sample Data					
	Vis, cs/100°F	100°F Vie Increase, %	Vis. cs/210°F	Neut. No., mg KOH/g	Oil Loss,
Initial 16 hr 24 hr 40 hr	15.19 16.82 18.24 25.38 49.59	10.7 20.1 67.1 226	3.99 4,32 4.61 6.06 10.66	0,26 0,63 0,89 1,10 2,27	928
Metal Specimen Data	ata		Test Cell Data	σl	
Weight change, mg/cm ² :	mg/cm ² : Al Fi Ag	+0.02 +0.02 +0.02	Sludge in oil:	il: 200-mesh filter Centrifuge	lter None iuge (a)
	Steel Cu Mg	+0.02 0.0 +0.18	Tube deposits:	its: Below oil level At and above oil level	vel Lt var soil level Lt var
Metal discolor: pitting, or el	Metal discoloration, deposits, pitting, or etching: Al Ti Ti Ag Steel	Lt yellow Lt brown Lt yellow Blue Orange	Test Conditions Sample temperature, Sample volume, ml Antrate, liter/hr Condensate eturn	nperature, °F uma, ml iter/hr	385 200 130 Yes

(a) Insufficient sample.

TABLE 150, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 0-65-28 AT 385°F

Sample Data

	Vis,	100°F Vis	Vis,	Neut, No.,	Overhead	Oil Loss,	Overhead Sample Acidity, Vis,	Sample Vis,
	cs/100°F	Increase, %	cs/210°F	mg KOH/g	Wt, g	wt %	mg KOH/g	cs/100°F
Initial	12.94	1	3.27	0.30	1			
16 hr	7	14.8	3.45	0.22	25.1			
24 hr		98.8	4.79	6.23	38.1			
40 hr	4	3, 136	27.86	17.22	65.0			
48 hr	1650	12,650	73.21	21.8	6.99	47	50°6	8.50
Metal Spe	Metal Specimen Data				Test Cell Data	ta		
Weight	Weight change, mg/cm ² :		0.0		Sludge in cil:	200-n	200-mesh filter	None
)			-0.02				Centrifuge	None
		Ag	-0.12					
		Steel	+0.08		Tube deposits:		Below oil level	None
		ű	-0.18			At an	At and above oil level	evel None
	· •	Mg	+0.14			g * - r		
Metal	Metal discoloration, deposits,	n, deposits,			Test Conditions	suo		
pitti	pitting, or etching:	ı	S	•				
•	5	Ti	S		Sample to	emperature,	, দি	
		Ag	Lt yellow		Sample v	Sample volume, ml		
		Steel	Black		Air rate,	Air rate, liter/hr	130	
		Cu	Orange		Condensa	Condensate return	°Z	
		Mg	Grey					

AT 385°F		Vis, Neut. No., Oil Loss,	cs/210°F mg KOH/g wt %	3.27 0.30	3,44 0.22	3,66 1.49	19,70 16,15	46.30 18.75 46	Test Cell Data	•	Centrifuge None			At and above oil None	level	Test Conditions		Sample temperature, °F 385	Sample volume, ml 200	Air rate, liter/hz 130	Condensate return Yes	
RESULTS OF REFLUX OXIDATION-CORROSION TEST ON 0-65-28 AT 385°F						3,66	19.70		Test Cell Data				Tube deposits:	-0.40 At and abov	+0,08	Test Conditions	NC	NC Sample temperature,	Lt yellow	Black	Slight etching	Grey
TABLE 151. RESU	Sample Data	Vie, 10	F - 1	Initial 12.94		24 hr 16, 44	244.2	861.7	Metal Specimen Data	Weight change, ing/cm2: Al		Ag	Steel	Sur Cu	Mg	Metal discoloration, deposits,	pitting, or etching: Al		Ag	Steel	Cu	Mg

TABLE 152, RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON O-65-31 AT 385°F

Vis, cs/100°F	10,25	None Trace None	
Overhead Sample Acidity, Vis, mg KOH/g cs/100	1. 23	200-mesh filter Centrifuge Below oil level At and above oil level	*F 385 200 130 No
Oil Loss, wt %	a 43	**	Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	 34.1 47.3 66.5 72.0	Sludge in oil: Tube deposits:	Test Conditions Sample temperature Sample volume, ml Air rate, liter/hr Condensate return
Neut, No., mg KOH/g	0.08 0.22 0.36 0.61 0.65		
Vis, cs/210°F	3, 23 3, 54 3, 68 4, 10 4, 39	0.0 0.0 0.0 10.04	NC Lt brown Lt yellow Blue-brown Orange Lt grey
100°F Vis Increase, %	14.7 22.5 43.7 59.0	y/cm ² : Al Ti Ag Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu
Vis, cs/100°F	Initial 13, 40 16 hr 15, 37 24 hr 16, 42 40 hr 19, 25 48 hr 21, 30 Metal Specimen Data	Weight change, mg/cm ² :	pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr Metal Spec	Weight	Metal o

TABLE 153. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON O-65-31 AT 385°F

ิส	
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			None Trace None None
Oil Loss, wt %	4		200-mesh filter Centrifuge Below oil level At and above oil level ture, °F 385 ml 200 nr 130 rn Yes
Neut, No., mg KOH/g	0.08 0.22 0.36 0.61 0.65		ts: me, er/h
		Test Cell Data	Sludge in oil: 200-r Tube deposits: Below At an Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F	3.23 3.53 3.68 4.07 4.35	Test	Tes
100°F Vis Increase, %	 14.3 22.1 42.2 57.6		0.0 +0.02 0.0 +0.02 +0.02 +0.04 NC Lt brown Lt yellow Blue-brown Orange Lt grey
10 on			AB Skeel Cou AB AB AB AB AB AB AB AB AB AB AB AB AB
Vis, cs/100°F	13.40 15.31 16.36 19.06 21.12	ata	Weight change, mg/cm ² : Al Ti Ag Steel Cu Mg Mg pitting, or etching: Al Ti Ag Steel Cu
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight cha
		M	

TABLE 154. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 65-L-114 AT 375°F

					• • • • • • • • • • • • • • • • • • • •		
vis, cs/100°F	100°E Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Wt %	mg KOH/g	Cs/100°F
7,	ı	3,54	0.10	! 1			
4.22	5.1	3.71	0.52	1.97			
79	9.3	3.78	6,56	39.0			
.02	18.4	4.06	0.70	63.1			
17.15	26.8	4,31	€8.0	73.1	41	1.12	11.08
Metal Specimen Data			Test Co	ell Data		•	
ige, mg		+0.04	Slud	ge in oil:	200-mesh fi Centri	lter fuge	None 0.15 m1/25
	Ag	+0.08		e deposits:	Belaw oil le	vel	L,t var
	Ca	+0.02		4	At and abov	e oil level	None
	Mg	+0.04					
loratio	n, deposits,		Test C	onditions			
r etchi	ng: Ti	Purple Purple	Sam	ple tempera	ature, °F	375	
	Ag	Purple	Sam	ple volume,	m l	200	
	Steel	Purple-g		rate, liter	hr	130	
	Cn	Brown	Con	densate ret	arn	N°	
	Mg	Purple					
PPI AND AND AND AND AND AND AND AND AND AND	14.79 15.02 17.15 en Data ange, mage, 9.3 18.4 26.8 30, depos	9.3 18.4 26.8 Z6.8 Tri Ag Steel Cu Mg on, deposits, ing: Tri Ag Steel Cu Mg	9.3 18.4 18.4 4.06 0.70 26.8 4.31 0.83 Tes	9.3 18.4 18.4 4.06 0.70 26.8 4.06 0.70 85 Tri 0.0 Ag +0.08 Steel 0.0 Cu +0.02 Mg +0.02 Mg +0.04 1Es Tri Purple Ag Purple	9.3 18.4 4.06 0.70 63.1 26.8 4.06 0.70 63.1	9.3 9.3 9.3 9.3 9.3 9.3 9.3 9.3	

TABLE 155. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 65-L-114 AT 385*F

	Vis, cs/100°F	100°F Vis Increase, %	Vis,	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Sample Acidity, Vis, mg KOH/g cs/100	Sample Vis, cs/100°F
Initial 16 hr 24 hr 40 hr	13.53 14.61 15.11 17.26 20.64	8.0 11.7 2 7.6 52.5	3.54 3.78 3.85 4.39 5.00	0.10 0.63 0.67 0.91	 33.4 49.2 79.5 91.8	55	1.43	11.20
Metal Spe	Metal Specimen Data			Test	Test Cell Data			
Weight	Weight change, mg/cm ² ;		0.0	ซึ่	Sludge in oil:	200-mesh filter Centrifuge	nesh filter Centrifuge	None Trace
		Steel Cu Mg	+0.06 0.0 -0.04	Ħ	Tube deposits:		Below oil level At and above oil level	Lt carbon Lt var
Metal c	etal discoloration, pitting, or etching:	depos	Purpie	Test	Test Corditions			
		Ti Ag Steel Cu	Dark purple Purple Purple-green		Sample temperature, Sample volume, ml Air rate, liter/hr	ature, °F , mi /hr	385 200 130	
		Mg	Purple	5		17 77 77 77 77 77 77 77 77 77 77 77 77 7	O.	

TABLE 156. KESULTS OF NO! REFLUX OXIDATION-CORROSION TEST ON 65-L-115 AT 375°F

Overhead Sample Acidity, Vis, g KOH/g cs/100°F				5 11.15		None	0.05 ml/25		Lt var									
l El				1,35		filter	ifuge)	evel	ve oil lev				375	200	130	Š) ; !
Oil Loss,				97		200-mesh filter	Centrifuge		Below oil 1	At and above oil level				ture, °F	ml	hr	rn	
Overhead Wt, g	14.7	21.5	34.8	40.5	II Lata	Sludge in oil:			Tube deposits: Below oil level	ı		Test Conditions		Sample temperature,	Sample volume, ml	Air rate, liter/hr	Condensate return	
Neut. No., mg KCH/g	0.09	0.31	0.39	0.43	Test Cell Lata	Slud			Tube			Test Co		Sami	Sam			
Vis, cs/210°F	3.59	5.79	3, 93	4.02		+0.04	-0.05	+0,02	+0.06	-0.30	-0,08		Tan	Grey	Tan	Blue-green	Slight pitting	Grey
100°F Vis Increase, %	5.8	7.7	12.7	15.6		/cm ² : Al	Ti	Ag	Steel	ű	Mg	Metal discoloration, deposits,	ng: Al	Ti	Ag	Steel	Cu	Mg
Vis, cs/100°F	14,33	15.44	16.15	16.57	Metal Specimen Data	Weight change, mg/cm2:						iscoloration	pitting, or etching:					
	Initial 16 hr	24 hr	40 hr	48 hr	Metal Spec	Weight						Metal d	pittin					

TABLE 157. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON 65-L-115 AT 385°F

Sample Data

	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss,	Overhead Acidity, mg KOH/g	Overhead Sample Acidity, Vis, g KOH/g cs/100°F
Initial 16 hr 24 hr 40 hr 48 hr	14.33 15.34 15.71 16.74 17.55	7.0 9.6 16.8 22.5	3.59 3.78 3.84 4.04	0.09 0.34 0.48 0.48	18.0 26.3 41.0 47.2	35	1.36	11.19
Metal Spe	Metal Specimen Data			Test C	Test Cell Data			
Weight	Weight change, mg/cm ² :	g/cm ² : Al Ti Ag	-0.06		Sludge in oil	200-mesh filter Centrifuge	ilter Íuge	None 0.30 m1/25
4. 2 4. 4.		Steel Cu Mg	+0.02 -0.16 -0.06		Tube deposits:	Below oil level At and above oil level	vel e oil level	None Lt var
Metal pitti	etal discoloration, pitting, or etching:	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel Cu	Lt tan Dark grey Tan Lt blue-green Dark brown Grey-brown	Teen n	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return	ture, °F ml hr irn	385 200 130 No	

TABLE 158, RESULTS OF NONREFLUX CHIDATION-CORROSION TEST ON 65-L-116 AT 375°F

Sample Data	ata						7	7
	Vis, cs/100°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Acidity, Vis, mg KOH/g cs/100	Vis, Cs/100°F
Initial	16.78	!	4.29	0.11	i i			
16 hr	•	5.4	4.49	0.56	15,3			
24 hr	18.25	8.8	4.57	99.0	21.9			
40 hr	19.05	13.5	4.78	0.88	33.9			
48 hr	19,60	16.8	4.89	0.98	39.0	27	2.21	11.04
Metal Spe	Metal Specimen Data	ا مد		HI	Test Cell Data	lta I		
Weight	Weight change, mg/cm2:	ig/cm ² : Al	0.0		Sludge in oil:	200-r	200-mesh filter	None
		Ti	+0.04				Centrifuge	None
		Ag	0.0					
		Steel	0.0		Tube deposits:		Below oil level	Lt var
		Ö	90.0-			At an	At and above oil level	vel None
		Mg	0.0					
Metal	discoloration	Metal discoloration, deposits,			Test Conditions	ons		
pitti	pitting, or etching:	ing: Al	NC	•				
	ı	Ti	Lt grey		Sample te	Sample temperature,	。 F 37	5
		Ag	White		Sample vo	Sample volume, ml	20	0
		Steel	Blue		Air rate, liter/hr	liter/hr	130	0
		ភី ;	Lt yellow		Condensate return	te return	No	0
		Mg	S Z					

TABLE 159. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON J-1003(a) AT 375°F

Overhead Sample Acidity, Vis, mg KOH/g cs/100°F	1.58 11.06		filter None ifuge None	Below oil level Lt var At and above oil level None	375 200 130 No
Oil Loss, wt % m	33	ata	oil: 200-mesh filter Centrifuge		Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return
Overhead Wt, g	20.0 29.1 45.5 52.4	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temp Sample volun Air rate, lite Condensate r
Neut. No., mg KOH/g	0.10 0.54 0.56 0.64				*
Vis,	3.80 4.00 4.06 4.29 4.45		0.00	+0.04 -0.06 +0.08	NC Grey Lt tan Blue Lt yellow NC
100°F Vis Increase, %	7.5 9.9 17.3 23.0		g/cm ² : Al Ti Ag	Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
Vis, cs/100°F	14.81 15.92 16.28 17.37	Metal Specimen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Spec	Weight		Metal c

(a) Blend (equal parts) of 65-L-114, 65-L-115, and 65-L-116.

TABLE 160. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON J-1003(a) USING WATER-SATURATED AIR AT 375°F

Sample Data

	Vis, cs/'00°F	100°F Vis Increase, %	Vis, cs/210°F	Neut. No., mg KOH/g	Overhead Wt, g	Oil Loss, wt %	Overhead Acidity, mg. KOH/g	Overhead Sample Acidity, Vis, & KOH/g cs/100°F
Initial	14.81	ŧ	3.80	0.10	;			
16 hr		6.8	3.99	0.61	19.9			
24 hr		9.5	4.05	0.64	29.1			
40 hr		16.0	4.25	0.74	46.2		,	·
48 hr	17.91	20.9	4.40	0.89	53.6	8	2.16	10.88
Metal Spe	Metal Specimen Data	قدر		Test Cell Data	ell Data			
Weigh	Weight change, mg/cm ² :		+0.02	Slud	Sludge in oil:	200-mesh filter	ilter	None
D		Ţ	+0.04			Centrifuge	fuge	0.05 ml/25
		Ag	0.0					
		Steel	+0.02	Tub	Tube deposits:	Below oil level	vel	Lt var
		Cu	-0.04			At and above oil level None	e oil level	None
	ď	Mg	+0.02					
Metal	discolorati	Metal discoloration, deposits,		Test C	Test Conditions			
pitt	pitting, or etching:	ning: Al	NC					
•	ò		Grey	Sam	Sample temperature,	ature, °F	375	
		Ag		Sam	Sample volume, ml	, ml	200	
		Steel	Blue	Air	Air rate, liter/hr	'hr	130	
		Ca	Orange	Con	Condensate return	nrn	No	
		Mg	NC					

(a) Blend (equal parts) of 65-L-114, 65-L-115, and 65-L-116.

TABLE 161. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON J-1007(a) AT 385°F

Sample Data

Vis, cs/100°F		None Trace	None vel Lt var	
Acidity, Vis, mg KOH/g cs/100		273-mesh filter Centafuge	Beiow oil level At and above oil level	*F 385 200 130 No
Oil Love, wt %	d]	2-0-E		ngerature, ume, ml iter/hr return
Overhead Wt, g 34.7 50.4 75.3	Test Cell Data	Sludge in oil:	Tube deposits:	Test Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Neut. No., mg KOH/g 0. 15 0. 60 6. 64 1. 63	•	06 02 02	02 16 06	9 d
Vis, cs/210°F 4.24 4.64 4.96 5.99 7.06		-0.06 -0.02 -0.02	+0.02 -0.16 -0.06	Lt purple Brownish purple Tan Blue Yellow-green Grey
100°F Vis Increase, % 13.6 22.9 58.8 95.5			Steel Cu Mg	Metal discoloration, deposits, pitting, or etching: Al Ti Ag Steel
Vis, cs/100°F 16.54 18.79 20.33 26.26 32.34	imen Data	Weight change, mg/cm ² :		etal discoloration, pitting, or etching:
Initial 16 hr 24 hr 40 hr	Metal Specimen Data	Weight		Metal d

(a) Blend (1:1) of O-62-3 and O-62-6.

TABLE 162. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON J-1007(a) AT 385°F

			None Frace	Lt var Lt var	
Oil Loss, wt %	6			level	385 200 130 Yes
Neut, No., mg KOH/E	0, 15 0, 66 0, 70 1, 01 1, 32	11 Data	Sludge in oil: 200-mesh filter Centrifuge	Tube deposits: Below oil level At and above oil level	Sample temperature, "F Sample volume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F	4.24 4.63 5.84 6.87	Test Cell Data	Slud	Tube	Samy Samy Air Conc
100°F Vis Increase, %	12.7 22.1 53.2 89.2			+0.02 -0.16 0.0	Lt brown Brown-red Yellow Blue Yellow-green Lt grey
러				Steel Cu Mg	posits, Al Ti Ag Steel Cu Mg
Vis, cs/100°F	16.54 18.64 20.19 25.34 31.29	ıta	Weight change, mg/cm ² :		Metal discoloration, deposits, pitting, or etching: Al Ti Ag Stee
	Initial 16 hr 24 hr 40 hr	Metal Specimen Data	Weight cha	·	Metal discoloration, pitting, or etching:

(a) Blend (1:1) of O-62-3 and O-62-6.

TABLE 163, RESULTS OF REFLUX OXIDATION-CORROSION TEST ON J-1007(a) AT 385° F

				None None	None None
	Oil Loss, wt %	50		nesh filter Centrifuge	Below oil level At and above oil level
	Neut. No., mg KOH/g	0.15 0.69 0.70 0.98 1.37		200-1	• •
	Vis, N cs/210°F	4.24 4.64 4.90 5.74 6.51	Test Cell Data	Sludge in oil:	Tube deposits:
			1	0.04	-0.02 -0.18 0.0
	100°F Vis Increase, %	13.1 21.9 50.1 78.7		A Ti Ag	Steel Cu Mg
	Vis, cs/100°F	16.54 18.70 20.17 24.82 29.59	ta	Weight change, mg/cm ² ;	
Sample Data		Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight chan	
Sar			Me		

(a) Blend (1:1) of O-62-3 and O-62-6.

385 200 130 Yes

Ĺų o

Sample temperature, Sample volume, ml

NC Brown-purple

Lt tan Blue

Al Ti Ag Steel Cu Mg

Test Conditions

Metal discoloration, deposits,

pitting, or etching:

Air rate, liter/hr Condensate return

> Yellow-brown Lt grey

TABLE 164. RESULTS OF NONREFLUX OXIDATION-CORROSION TEST ON J-1011(a) AT 385°F

Sample Data

	Vis,	· ří	Vis,	Neut. No.,	Overhead	Oil Loss,	Overhee Acidity,	9
	cs/100 F	Increase, %	4.017/83	mg KOH/g	Wt, B	Wt /0	mg hong	G C 100° K
Initial	28, 38	1	5.35	0.14	ł			
16 hr	30.62	7.9	5.63	0.04	4. 0			
24 hr	31, 33	10.4	5.71	90.0	5.4		æ.	
40 hr	32.35	14.0	5.89	0.07	8.0			
48 hr	33.37	17.6	9. 00	0.08	8.9	13	1.73	18.05
Metal Spe	Metal Specimen Data			Test Cell Data	11 Data			
Weight	Weight change, mg/cm ² :	g/cm ² : Al	+0.06		Sludge in oil:	200-mesh filter Centrifuge	er	None 0.05 m1/25
		Ag	+0.04				o '	
		Steel	-0.02		Tube deposits:	Below oil level	el	None
		Cn	-0.73			At and above oil level	oil level	None
		Mg	-0.06	,				
Metal	discoloratic	Metal discoloration, deposits,		Test Co	Test Conditions			
pitti	pitting, or etching:	ing: Al	NC					
•	5		Tan	Samı	Sample temperature,	ture, • F	385	
		Ag	White	Samı	Sample volume, mi	11.	200	
		Steel	Gold	Air 1	Air rate, liter/hr	la m	130	
		ű	Severe pitting		Condensate return	u.:	°Z	
		Mg	NC)				

(a) Blend (1:1) of O-64-13 and O-64-25.

TABLE 165. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON J-1011(a) AT 385°F

Oil Loss,		None 0.05 ml/25 None None	385 200 130 Yes
Oil Lo	15	200-mesh filter None Centrifuge 0.05 Below oil level None At and above oil level None	îri
Neut. No., mg KOH/g	0.14 0.07 0.07 0.09 0.11	ů	Conditions Sample temperature, Sample volume, ml Air rate, liter/hr Condensate return
Vis,	5.35 5.63 5.71 5.91 6.02 Test Cell Data	Sludge in oil: Tube deposits:	8 a
8 %		-0.02 0.0 +0.04 0.0 -0.84	NC Lt tan I.t grey Brown Moderate etching
100°F Vi Increase,	8.1 10.2 15.5 19.0	: Al Ti Ag Steel Cu Mg	osits, Al Ti Ag Steel Cu
Vis, cs/100°F	28.38 30.69 31.27 32.79 33.76	Weight change, mg/cm ² :	Metal discoloration, depo pitting, or etching:
	Initial 16 hr 2 ' hr 40 hr 48 hr : stal Specimen Data	Weight ch	Metal dispitting,

⁽a) Blend (1:1) of O-64-13 and O-64-25.

TABLE 166. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON J-1020(a) AT 385°F

	Vis, Neut. No., Oil Loss, cs/210°F mg KOH/g wt %		5,43 0,06				Test Cell Data	Sludge in cil: 200-mesh filter
	100°F Vis Increase, %	;	7.2	10.1	15.5	19.0		1 +0.02
	Vis, cs/100°F	27.88	29.89	30,70	32,20	33,18	ata	inge, mg/cm ² : Al
Sample Data		Initiai	16 hr	24 hr	40 hr	48 hr	Metal Specimen Data	Weight change, mg/

None None None	None						
ilter fuge evel	At and above oil level		385	200	130	Yes	
200-mesh filter Centrifuge Below oil level	At and abov		ature, °F	, ml	/hr	urn	
Sludge in cil: 200-mesh filter Centrifuge Tube deposits: Below oil level	•	Test Conditions	Sample temperature, °F	Sample volume, ml	Air rate, liter/hr	Condensate return	
+0.02 0.0 +0.02 +0.06	+0,10	ŊŊ	Lt tan	Lt yellow	Purple	Brown	NC
2: Al Ti Ag Steel	Cu Mg	posits, Al	Τί	Ag	Steel	Cu	Mg
e, mg/cm		ration, de tching:	ì				
Weight change, mg/cm ² :		Metal discoloration, depos pitting, or etching:)				
₩e		Me pi	•				

(a) Blend (1:1) of O-64-2 and O-64-13.

TABLE 167. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON J-1021(a) AT 385°F

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)		

			None None	None None	
Oil Loss, wt %	13		lte r uge	vel e oil level	385 200 130 Yes
Neut. No., mg KOH/g	0.04 0.11 0.17 0.26	Data	Sludge in oil: 200-mesh filter Centrifuge	Tube deposits: Below oil level None At and above oil level None	Sample temperature, *F Sample velume, ml Air rate, liter/hr Condensate return
Vis, cs/210°F	5.19 5.42 5.51 5.64 5.72	Test Cell Data	Sludge	Tube	Test Conditions Sample temp Sample volut Air rate, lit Condensate
100°F Vis Increase, %	6.5 8.5 11.8 13.8		000	0.0	NC Lt tan Lt yellow Blue-green Yellow-red
그램			A Ti	Steel Cu Mg	osits, Al Ti Ag Steel Cu
Vis, cs/100°F	28.07 29.90 30.45 31.38	eta	Weight change, mg/cm ² :		l etal discoloration, deposits, pitting, or etching: Ti Ag Stee
	Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight cha		l etal disc pitting, c

(a) Blend (1:1) of O-64-2 and O-64-25.

TABLE 168. RESULTS OF REFLUX OXIDATION-CORROSION TEST ON J-1025(a) AT 385°F

	, ,			None None None	
	Oil Loss, wt %	. 15		ter 1ge vel	385 200 130 Yes
	Neut, No., mg KOH/g	0.12 0.05 0.10 0.15 0.17	Data	Sludge in oil: 200-mesh filter Centrifuge Tube deposits: Below oil level At and above oil level	t Conditions Sample temperature, °F Sample volume, ml Air rate, liter/hr Condensate return
	Vis, cs/210°F	5.23 5.47 5.57 5.75	Test Cell Data	Sludge Tube d	Sample temporare Sample voluments Air rate, lit Condensate
	100°F Vis Increase, %	6.5 9.1 12.6 15.4		+6. C2 +0. 06 -0. 02 +0. 06 +0. 08 +0. 02	NC Lt tan Lt yellow Purple Brown Lt yellow
	Inc			Al Ti Ag Steel Cu Mg	osits, Al Ti Ag Steel Cu
	Vis, cs/100°F	28. 19 30. 01 30. 76 31. 75 32. 54	ata	Weight change, mg/cm ² :	Mrtal discoloration, deposits, pitting, or etching: Ti Ag Stee
Sample Data		Initial 16 hr 24 hr 40 hr 48 hr	Metal Specimen Data	Weight cha	Mrtal disc pitting, c

(a) Blend (equal parts) of O-64-2, O-64-13, and O-64-25.

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Oxidation-corrosion test data are presented for 46 lubricants, 40 MIL-L-308 type lubricants and six MIL-L-23699 type lubricants, evaluated at one or more temperatures within the range of 350 to 400°F. In addition, the compatibility of selected lubricants when blended with lubricants of the same general class was avaluated. The test conditions which were varied were temperature and the use of reflux and honreflux glassware configurations. Relatively mild oxidative degradation occurred at 350 and 375°F test conditions. Using an arbitrary rating point of 100 percent viscosity increase (100°F) as the maximum viscosity increase allowable for satisfactory performance, 23 of the 37 lubricants evaluated at 385°F were satisfactory using the nonreflux test procedure. Sixteen of the 29 lubricants evaluated at 390°F were satisfactory and only four of the 16 evaluated at 400°F provided satisfactory performance. The effect of condensate return at 385°F revealed that the majority of lubricants evaluated were unaffected.

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